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PARAMETERIZATION OF OVERWATER

HORIZONTAL WIND VARIABILITY

by

Gordon E. Schacher

June 1986

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Prepared for: Naval Surface Weapons Center
Dahlgren, VA 22448

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RADM R.H. Shumaker
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This report was prepared by:

G.E. Schacher

G.E. SCHACHER
Professor of Physics

Approved by:

G.E. Schacher

G.E. SCHACHER
Chairman, Dept. of Physics

Released by:

J.N. Dyer

J.N. DYER
Dean of Science and Engineering

Unclassified

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Data from four overwater diffusion experiments have been analyzed to parameterize the overwater horizontal wind variability. The parameterization involves three production mechanisms: shear, buoyancy, and a larger scale process loosly refered to as mesoscale. All three processes have been parameterized for averaging times from 1 min to 1 hour.

(continued)

Item 20. (continued)

The variability has also been parameterized in term of the surface layer stability, which we find to be an insufficient parameter. The results are applicable to the overwater coastal regime.

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Several people have contributed significantly to various aspects of the work reported here. Don Spiel was responsible for much of the data asquisition. Steve Crain spent months working on a parameterization which, unfortunately, did not work out. Chuck Skupniewicz helped the author with many valuable conversations and Torben Mikkelsen provided inspiration and help with the parameterization that did work.

I. INTRODUCTION

One of the main difficulties in developing over water diffusion models is the lack of an extensive data base. The Environmental Physics Group of the Naval Postgraduate School has participated in several at-sea, coastal, transport and diffusion experiments(Schacher, et. al. 1982). The design of the experiments was such that diffusion data were obtained only during periods of onshore winds. Thus, although the data is extremely valuable, only a limited set of meteorological conditions were tested.

During the diffusion experiments, horizontal wind variability was determined over a much wider range of conditions. Since wind variations drive diffusion, these data can augment direct diffusion measurements. These data are especially valuable when one considers the high cost of field tracer measurements.

The data have been obtained off the California coast, at one location in the Santa Barbara Channel and another north of Pt. Conception. The northern location is an open coastal area, well exposed to the prevalent north westerlies. The Channel location is strongly influenced by surrounding land areas, as is readily seen from the frequent eddies in the whole area. At both locations, data were obtained during the Summer and the Winter, an attempt being made to obtain data over as wide a range of conditions as possible. The wind variability experiments were

run for nearly 24 hours a day, yielding over 400 hours of usable data.

The purpose of the work reported here is to determine the proper parameterization to use to characterize the horizontal wind variability. If we can correctly do this, it should ultimately lead to the correct parameterization for overwater diffusion modeling. The measurements were made at an offshore location, with a single set of sensors, so only the local turbulence was determined. The local turbulence is driven by a number of forces, which must be considered in developing the parameterization. The obvious forces are:

surface wind shear (U or U*)

convection (H or w*)

mesoscale activity

swell and wind waves.

The parameters shown in parentheses will be described later in this report. It may also be necessary to have the atmospheric stability (Z/L) as a parameter.

The local measurements are sufficient to determine the parameters shown in parentheses. The only way we have of determining mesoscale activity is through the times of occurence and strength of the sea-breeze cycle. Such an analysis is an important part of this report.

We have attempted to determine affects due to swell and wind-wave heights. However, the quality of wave data was poor and no usable results were obtained.

Synoptic data are available for the periods we are using. This information is mostly useful for assessing the large scale forcing that drives the more local conditions. The parameterization we develop must depend on local measurements. Later studies of synoptic data could be useful in developing a predictive scheme.

II. EXPERIMENTAL DETAILS.

Complete descriptions of the experiments from which these data were obtained can be found in other reports (Schacher, 1981, 1983). This section will contain only a brief description of those details needed to clarify the results presented here. Rough charts of the central California coast, showing the two locations where data were obtained, are shown in Figures 1.

At both locations tracer experiments were performed in the vicinity of a fairly flat beach with several miles of low profile inland terrain. The majority of the wind variability data was obtained within 3-5 miles of the beach, but some data was obtained at other nearby locations. No effects due to ship location or motion have been detected in these data, so these influences will not be discussed in this report.

The data were obtained from the ship R/V Acania, which was equipped with a complete suite of meteorological equipments so that the following data were obtained:

- sea surface temperature,
- air temperature (17ft and 60ft),
- wind speed and direction (17ft and 60ft),
- dewpoint temperature (17ft and 60ft),
- micro-turbulence (hot-films at 60ft),
- inversion height (acoustic sounder),
- boundary layer structure (radiosonde),
- wave height (observation estimates).

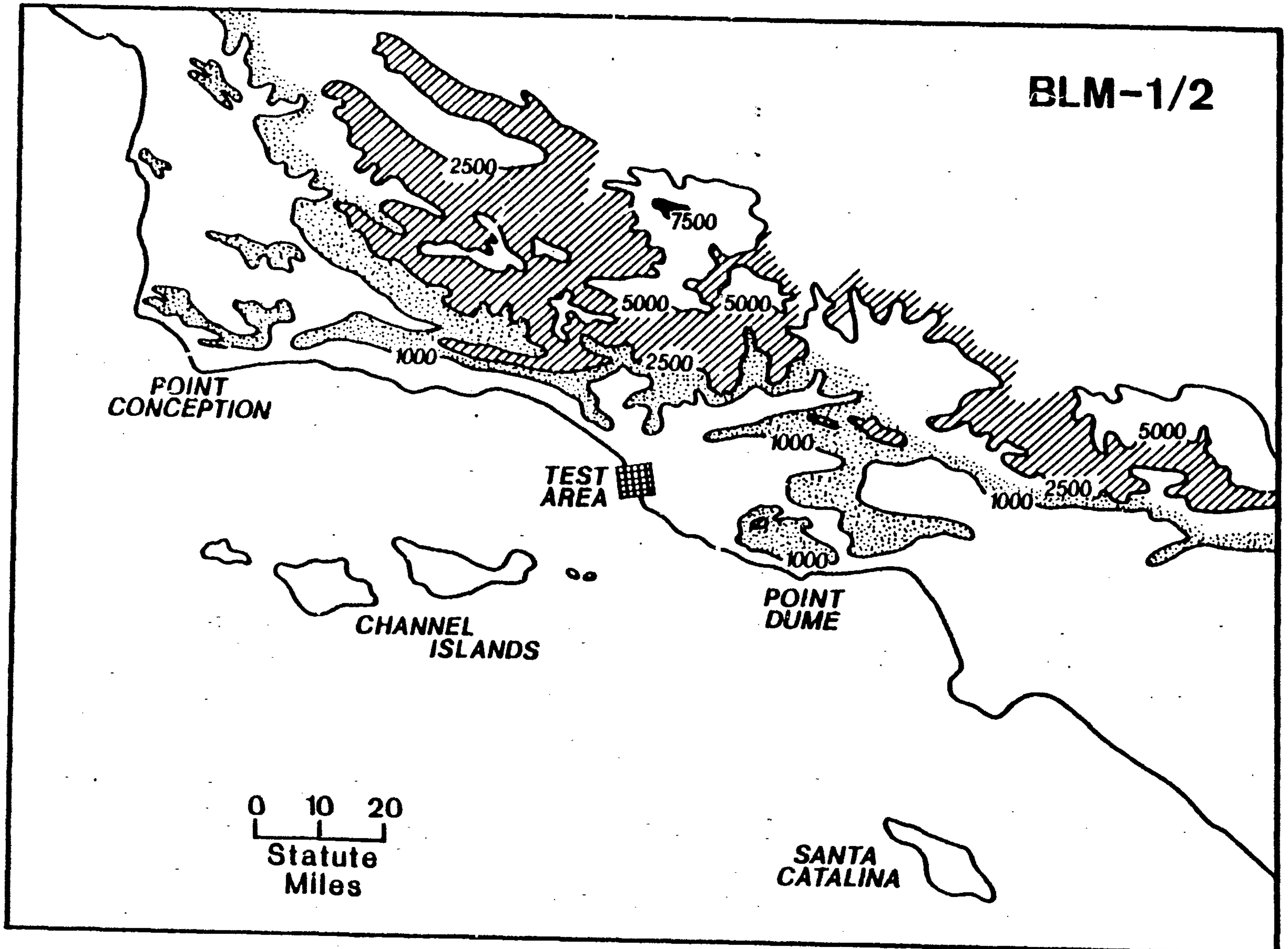


Figure 1. Locations on the central California coast where tracer experiments were performed and wind variability data obtained, BLM-1,2.

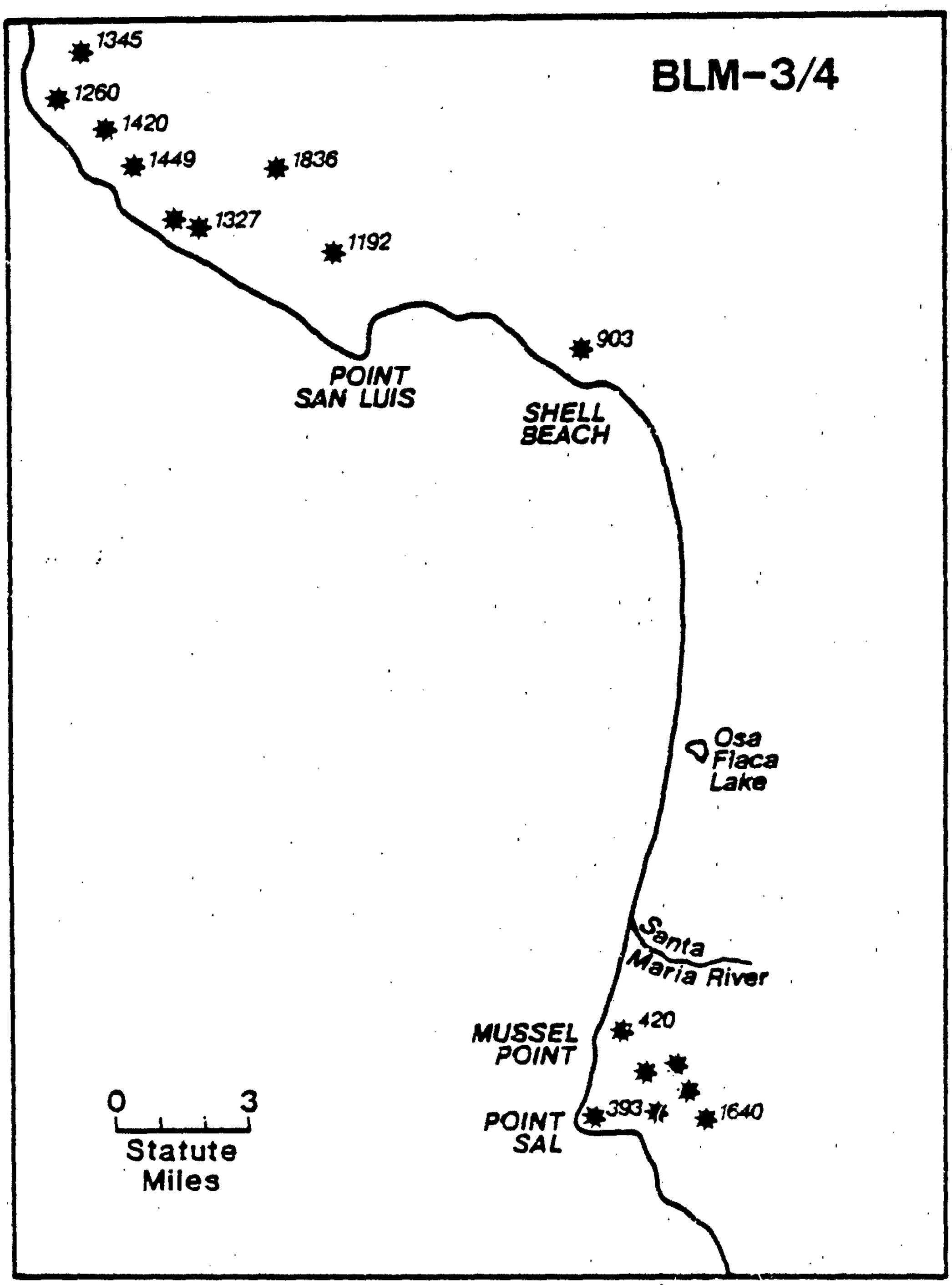


Figure 2. Locations on the central California coast where tracer experiments were performed and wind variability data obtained, BLM-3,4.

The low profile, narrow beam configuration of the ship is such that ship influence on the flow is minimal. Also, data obtained when the relative wind was from the aft where ship influence could be a factor have been rejected, and are not included in these analyses.

The basic sampling rate for all temperature and wind data was approximately 1 second. Wind data were processed into 10 sec averages and temperature data into one-half hour averages. The 10 sec wind data were recorded in separate files. Every half hour averages of all meteorological parameters were produced, including calculated quantities such as water vapor mixing ratio, Monin-Obukhov length, friction velocity, etc.

Since it is difficult to unambiguously determine the boundary layer depth from acoustic sounder records in real time, this parameter was only approximately known during the cruise. Accurate analyses, including the radiosonde results, were performed at a later time and all results recalculated. It was during the post-cruise analysis that rejection criteria were applied, such as a bad relative wind direction, and a clean data set produced.

A pendulum system was used to detect ship roll so that this velocity component could be removed from the wind direction results. Analyses of data with and without this correction applied showed little difference in the results.

For the analyses reported here, the 10 sec average wind data were processed into means and standard deviations for 1 min, 3 min, 10 min, 1/2 hour and 1 hour periods. Then, the 1, 3, and 10

min results were each averaged over the same 1/2 hour periods and the bulk meteorological parameters averaged for those same periods. This yielded sets of mean conditions and short and long term average wind statistics over the same periods for direct comparison purposes. It is these data that are presented in this report.

III. METEOROLOGICAL CONDITIONS.

Complete descriptions of the meteorological conditions are included in the former reports. As in the former section, the descriptions included here are brief and presented in order to clarify the results. Descriptions of the areas where theexperiments were carried out and local influence on the meteorology are also included.

Ventura: BLM 1 and 2

Ventura lies within the Los Angeles Bight, an embayment formed by the Santa Barbara Channel, Santa Monica Bay, and the Gulf of Santa Catalina. Pt. Conception, the surrounding hills, and the Channel Islands strongly affect the local flow and produce conditions controlled by the interplay of numerous local influences and mesoscale features which are typical of the general coastal area. The air flow in this area is quite different than over the majority of the California coast where an air mass reaches the shore after a long over-water fetch.

Immediately to the north, the coastline runs in a generally east-west direction to Pt. Conception, which is approximately 50 miles away. The geographic features cause many effects, the major ones being:

1. The mountains to the north act as a partial barrier to the normal movement of air from the northwest.

2. These mountains and the east-west orientation of the shore turn the wind to a westerly direction and produce a complex pattern of eddies.

3. The surrounding high hills contain the cool, moist marine air. Only infrequent, strong, synoptic air mass changes displace the marine air.

4. Due to nighttime downslope drainage from the surrounding hills, the diurnal land-sea breeze cycle is very strong, being enhanced by the local topography.

Pismo Beach: BLM 3 and 4

Pismo Beach is approximately 50 miles north of Pt. Conception, in a fairly open coastal area. Pt. Buchon, with 1000 to 2000 foot hills, lies immediately to the north, projecting some 5 miles out to sea. The point influences the local flow somewhat but the influence appears to be slight. The immediate inland hills are low, giving a weaker land-sea-breeze cycle than near Ventura. The experiments were carried out at the mouth of the Santa Maria valley, which steers the local flow slightly. The entrance to the valley at the beach is approximately 8 miles wide and the immediate hills on each side of the valley are only one to two hundred feet high, so their effect is small. The area is representative of an open California region where air mass predominantly northwest flow with a long over-water fetch, and by the land-sea breeze cycle.

General Meteorological Conditions:

During the Summer, the North Pacific semipermanent high lies to the west of the area and controls the synoptic scale flow. Clockwise flow around the high produces northwesterlies along much of the coast, with the local sea-breeze turning the wind more westerly. The general onshore flow is aided by the inland thermal trough which is created by overland heating. Strong subsidence creates the prevalent capping inversion and the occasional passage of weak upper level troughs will dissipate or lift the inversion for periods of 12-24 hours.

During the Fall, the building of high pressure in the Great Basin causes frequent Santa Ana conditions. The pattern of storms and upper level westerlies moves further south breaking up the summer pattern. Frontal passage becomes more frequent and the subtropical high becomes displaced or shrinks, resulting in a break up of the marine inversion.

During the Winter, frontal passage becomes much more frequent and strong surface westerlies often follow the passage. Santa Ana winds can still occur when the surface pressure in the Great Basin becomes sufficiently high. Also, the Pacific High and capping inversion can reform between frontal passage occurrences.

During the Spring, the storm pattern moves north, the Pacific High again becomes the dominant feature. Cold lows pass frequently, followed by strong westerlies.

When the synoptic pressure gradient is weak, local heating plays a dominant role, producing the sea-breeze cycle. Heating of the land during the day induces convection, and the rising air

causes onshore flow, the sea-breeze. During the night the situation, and flow, are reversed. The cycle is strong only when solar heating is strong. Thus the cycle is more likely to be present during the warmer months of the year and will be supressed by clouds.

The following are general descriptions of the meteorological conditions during the test periods.

BLM-1 (September 1980)

The whole period was dominated by the Pacific high. All frontal activity was to the north of California. The thermal low over Mexico was not strong enough to produce a dominant onshore flow. The surface pressure gradients in the coastal region were weak, so that the local flow was dominated by the diurnal land-sea-breeze cycle. Low subsidence inversions were present under the dominant high pressure. Weak Santa Ana conditions can occur under these conditions.

BLM-2 (January 1981)

The Pacific high was unusually strong, producing a mini-drought for what is normally the beginning of the rainy season for California. Frontal passages were again far to the north. There was no well established onshore flow regime except for a short period during 1/12-1/13 when the surface gradient in the Southern Califrornia area increased. As before, the land-sea breeze cycle should dominate, however, fairly persistent highs

over the inland western U.S. strengthened the offshore flow so that periods of sea breeze were shortened.

BLM-3 (December 1981)

Synoptic scale features and associated West Coast flow patterns were typical for this time of the year. An upper air North-South ridgeline over the western states was the dominant feature and led to generally weak surface pressure gradients off the southern California coast. The Mexican thermal low and afternoon sea breeze determined the flow associated with the passage of a fast moving upper wave, and associated precipitation and moderate northwest winds.

BLM-4 (June 1982)

The synoptic scale conditions and resulting precipitation and coastal wind regimes were atypical for the early summer season. The Mexican thermal trough should dominate this region, with resulting light coastal winds influenced by the sea-breeze during this period. Two upper level troughs passed over the West Coast during the period. The first (22 June) was a fast moving short wave and the second (28-30 June) was a deep system associated with a closed low at 500 mb, which became nearly stationary over central California. Both systems had considerable north-south extent which led to the southern California surface pressure patterns reflecting their passage. This resulted in a greater than normal onshore pressure gradient

and a fairly steady onshore wind, lacking the usual strong land-sea breeze cycle. Hence, strong onshore winds occurred.

IV. PARAMETERIZATIONS.

In this work we are attempting to parameterize the wind variance in terms of some easily used schemes based on local meteorological measurements. We have investigated the use of the wind speed, U, the friction velocity, U_*, the convective mixing velocity, w_*, and a measure of stability, using the Monin Obukhov length (10/L), and a modified Pasquill-Gifford class. This section describes each of these parameters.

All of the parameters needed, with the exception of the wind speed, require the surface layer scaling parameters or the momentum and heat fluxes. We determine these quantities from the bulk-aerodynamic method, which uses fairly easily measured air-surface differences of wind, temperature, and moisture. For surface values, we measure the temperature and assume zero wind speed and 100% relative humidity.

The quantities we wish to determine, and their relations to the scaling parameters, are:

Monin-Obukov length, $L = (T/kg)(U_*^2/H)$, (1)

surface virtual heat flux, $H = \rho C_p U_* \Theta_{v*}$, (2)

and, convective mixing velocity(Kaimal, et. al.,1976)

$$w_* = [\ (g/T)\ H/Z\ ]^{1/3}. \tag{3}$$

In these equations, T= absolute temperature, g= acceleration due to gravity, k= von Karman's constant, ρ= air density, C_p= specific heat at constant pressure, and Z_i= the boundary layer

depth. Θ_{v*} is the virtual potential temperature scaling parameter,

$$\Theta_v = T + 0.0098Z + 0.00061Tq, \tag{4}$$

where q is the water vapor mixing ratio.

In order to use these equations, the scaling parameters are needed. For some quantity X, the relation between the air and surface values of X and its scaling parameters is

$$X_z - X_s = (X*/\alpha_X k)\ [\ln (Z/Z_{oX}) - \Psi_X(L)]. \tag{5}$$

Z_o is the roughness length and Ψ the stability correction function to the logarithmic profile, which is normally written as a function of L, as indicated. α is the turbulence diffusivity ratio.

Self consistent constants and functions must be used in these equations if correct results are to be obtained. These quantities have been discussed at length in the literature (Businger,1973). For the quantities used in this work and a description of the iterative procedure used to obtain solutions, see Schacher, et. al. 1982.

All of the above parameters are local variables, which means that they can be determined from locally measured meteorological parameters (wind speed, air-sea temperature difference, dewpoint temperature, and inversion height). They only account for turbulence which is generated by shear and buoyancy. Turbulence is also generated by mesoscale motions and, if this source makes an important contribution to the scales of

motion investigated here, our parameterization will only account for a portion of the turbulence energy. This will be discussed more fully later in this report.

V. THEORY.

The following treatment is from the work of Hojstrup (1982), where he developes expressions for the turbulence intensity as functions of U_* and w_*. He considers the two sources of turbulence we mentioned in the previous section, shear production and buoyancy production, models their contributions to the velocity spectra, and integrates the spectra over the appropriate frequency range to determine the velocity variances. The following will be a brief description of the Hojstrup treatment, refer to his paper for a more complete description.

The horizontal, transverse velocity spectrum has two components

$$fS(f) = A(\alpha)w_*^2 + B(\beta)U_*^2, \qquad (6)$$

where f is the frequency, $S(f)$ the spectral intensity, w_* and U_* were described in the former section, and $A(\alpha)$ and $B(\beta)$ are functions of the variables

$$\alpha = fZ_i/U, \quad \beta = fZ/U. \qquad (7)$$

The functions, A and B, were determined by matching model results to the Kansas (Kaimal et. al. 1978) and Minnesota (Kaimal et.al., 1976) data. A complete description in the methodology is contained in Hojstrup (1981). Note that Hojstrup wrote the first term of Equation 6 as a function of $(-Z_i/L)$ and we have converted it to w_*.

Upon integration of the spectral intensity, the velocity variance becomes

$$\theta_v^{\,2} = 0.7\ k^{2/3} w_*^{\,2} + 2.7\ \frac{(1-Z/Z_i)^2}{(1+2.8\ Z/Z_i)^{2/3}}\ U_*^{\,2}, \tag{8}$$

where k= 0.35 is von Karman's constant. We use 0.35 rather than the more conventional 0.4 in order to be consistent with the calculations we made to determine U_* and w_* from our data. The first term is normally written as

$$0.7\ (-Z_i/L)^{2/3}\ U_*. \tag{9}$$

This clearly points out that the first term only contributes during unstable conditions, when convection is present.

It is obvious that the first term in Equation 8 contains Z_i, through w_*, because the strength of convective mixing depends on the mixing depth. The second term contains Z_i, through the ratio Z/Z_i, which is present to account for the decrease in surface shear produced turbulence with height above the surface. The correction factor is 1 at the surface. Since our measurements are all within the surface layer, this factor may not be appropriate. However, for a very low inversion it may play a roll in indicating supression of turbulence at our measurement height (20m). This will be explored later in the results section. Values of this correction for various Z_i are given in the following table.

Z_i(m)	$F(Z_i)$
1000	0.926
700	0.896
500	0.859
300	0.777
100	0.476

Table 1. Correction factors for shear produced turbulence due to the presence of the temperature inversion.

Our results are the variances of the horizontal wind direction, which can be simply related to the velocity variance with

$$\sigma_\theta{}^2 = \sigma_V{}^2/U \; . \qquad (10)$$

For what follows we drop the height correction in the second term of Equation 8. Also, we recognize that the overland sprectra from which Hojstrup's model was obtained probably do not adequately represent the overwater case we are dealing with. Thus, the whole formulation reduces to

$$\sigma_\theta{}^2 = C_w k^{2/3} (w_*/U)^2 + C_u (U_*/U)^2, \qquad (11)$$

or,

$$= [\; C_w \, (-Z_i/L)^{2/3} + C_u \;] \, (U_*/U)^2, \qquad (12)$$

where C_w and C_u are constants to be determined from the overwater

data. Note that we have supressed the factor $F(Z_i)$ in the U_* term; we may need to add it later if it proves to be needed. Both forms will be used in what follows. For simplicity we will write $C_w' = C_w k^{2/3}$.

Note that what we have done at this point is to show the manner in which the variance should depend on the scaling parameters, and leave the final form to evaluating the constants C_u and C_w from the data.

It may be convenient to write the scaling velocity as a function of the wind speed and drag coefficient

$$U_* = C^{1/2}U. \qquad (13)$$

Following Equation 5, the drag coefficient can be written as

$$C^{1/2} = C_N{}^{1/2}[1 - C_N{}^{1/2}\Psi/k]^{-1}, \qquad (14)$$

with the neutral stability drag coefficient

$$C_N{}^{1/2} = k/\ln(Z/Z_o). \qquad (15)$$

For unstable conditions(Businger,1973)

$$\Psi = 2\ln[(1+x)/2] + \ln[(1+x^2)/2] - 2\tan^{-1}x + \pi/2, \qquad (16a)$$

with $$x = (1-15z/L)^{1/4},$$

and for stable conditions

$$\Psi = -4.7(Z/L) \tag{16b}$$

At this point, the parameterization reduces to using the stability (L), inversion height (Z_i), wind speed (U), and roughness length (Z_o) or neutral drag coefficient (C_N) to obtain the proper parameterization.

The roughness length, or the drag coefficient, over water depends on the wind speed through wind-wave interaction. We have used the Kondo (1975) formulation in determining the scaling velocity and Monin-Obukhov length from our data. In what follows we will use the Garrett (1977) formulation:

$$10^3 C_N = 0.75 + 0.067\ U. \tag{17}$$

Using a different formulation (Garrett) for the subsequent calculations will introduce a slight scatter in the results. The two formulations are very close except at low wind speeds so there will be little effect except in that region. At low wind speeds the shear produced turbulence is a very small fraction of the total so the formulation used is unimportant there. We now have

$$(U_*/U)^2 = (7.5\times10^{-4} + 6.7\times10^{-5}\ U)\ F(L), \tag{18}$$

with

$$F(L) = [1 - C_N^{1/2}\ \Psi/k]^{-2}. \qquad (19)$$

Obviously, this is not a closed form solution since L depends on U. All coefficients were determined by an iterative calculation when the data was obtained.

Rather than do another iterative calculation for the results presented here, and in order to clarify the results, we calculate F(L) using the old value of L and Equation 19. Representative values of F(L) are given in the following table.

	F(L)		
Z/L	U=1m/sec	U=10m/sec	U=20m/sec
10	0.04	0.03	0.02
2	0.31	0.25	0.20
1	0.52	0.44	0.38
0.1	0.93	0.91	0.89
0	1.0	1.00	1.00
-0.1	1.04	1.06	1.07
-1.0	1.20	1.28	1.36
-2.0	1.28	1.39	1.49
-10.0	1.58	1.87	2.21

Table 2. Stability correction factor as a function of wind speed and stability.

Note that Ψ for stable conditions is given by $-4.7\ Z/L$. The range of conditions chosen in Table 3 is not realistic. At wind speeds of 10 m/sec or higher Z/L will be near zero since the air-sea temperature difference can never be large enough for buoyancy to overcome shear production at these high wind speeds.

Equations 11 and 12 can now be rewritten as

$$\sigma_\Theta^{\,2} = C_w{}'(w_*/U)^2 + C_u F(L)(7.5\times10^{-4} + 6.7\times10^{-5}U), \qquad (20)$$

where $C_w{}' = k^{2/3}\ C_w = 0.497\ C_w$.

$$\sigma_\Theta^{\,2} = [C_w(-Z_i/L)^{2/3} + C_u]\ F(L)(7.5\times10^{-4} + 6.7\times10^{-5}U) \qquad (21)$$

The first form is used for w* and U parameterizations and the second for stability parameterization and for the effects due to inversion height. Recall that we may need to use the inversion height correction to C_u (see equation 8) for low inversions. Another form of Equation 21 is useful for examining the dependence on stability. It is found by writing the term in square brackets as

$$C_w[(Z_i/Z)(-Z/L)]^{2/3} + C_u\ . \qquad (21a)$$

Of course, equations 21 and 21a leave both L and U as parameters, stability does not appear as a sufficient variable.

We must reemphasize that none of the above addresses sources of turbulence other than shear and buoyancy production.

VI. DESCRIPTION OF THE DATA.

As will be shown in the following section, successful parameterization of the wind variability depends on segmenting the data into wind regimes. The situations are different when the wind is dominated by synoptically driven, northwest flow or by the sea-breeze cycle. The means by which the separation into these two regimes is made is by examination of the wind direction records.

Figure 3 shows an example of a time history of the wind direction, wind speed, and wind direction standard deviation. The full set of time histories is in Appendix A. The dark bars on the graphs indicate when a stable onshore flow is present. All other periods of time are characterized by large variability in both wind speed and wind direction. Note that the onshore flow could be the result of either synoptic forcing or a well established sea-breeze. As can be seen from the strong diurnal cycle in Figure 3, our data were obtained during periods when the sea-breeze cycle was a major factor. In what follows, we divide the data into cases where a well established onshore flow is present (stationary) and when it is not.

The direction standard deviation figures show two different one-hour averages. One, open circles, are the one-hour average standard deviations over the hour preceeding the time shown. The second, solid dots, are the averages of all one minute standard deviations for that hour.

In the analyses that follow, we will be dealing with the following data

wind direction standard deviations:

one-hour averages

1/2 hour averages

1/2 hour averages of 1min, 3 min, and 10 min averages that occur in that 1/2 hour

wind speed

wind direction

stability

inversion height

convective mixing velocity

friction velocity (surface layer scaling velocity)

For the four operations, there are a total of 859 1/2-hour files of these data. The voluminous printouts of these data are contained in Appendices A and B.

There are rather substantial difficulties in interpreting these data. What is needed is to have available subsets of the data when the conditions are well known and where a single parameter can be identified as the dominant factor in determining the wind variability. For example, one would like to determine variability as a function of wind speed. The dependence may be different for onshore or offshore flow and for different inversion heights and different stabilities. Thus, one needs σ vs. U for an onshore flow and for an offshore flow case where the inversion heights and stabilities are the same. Such clean data

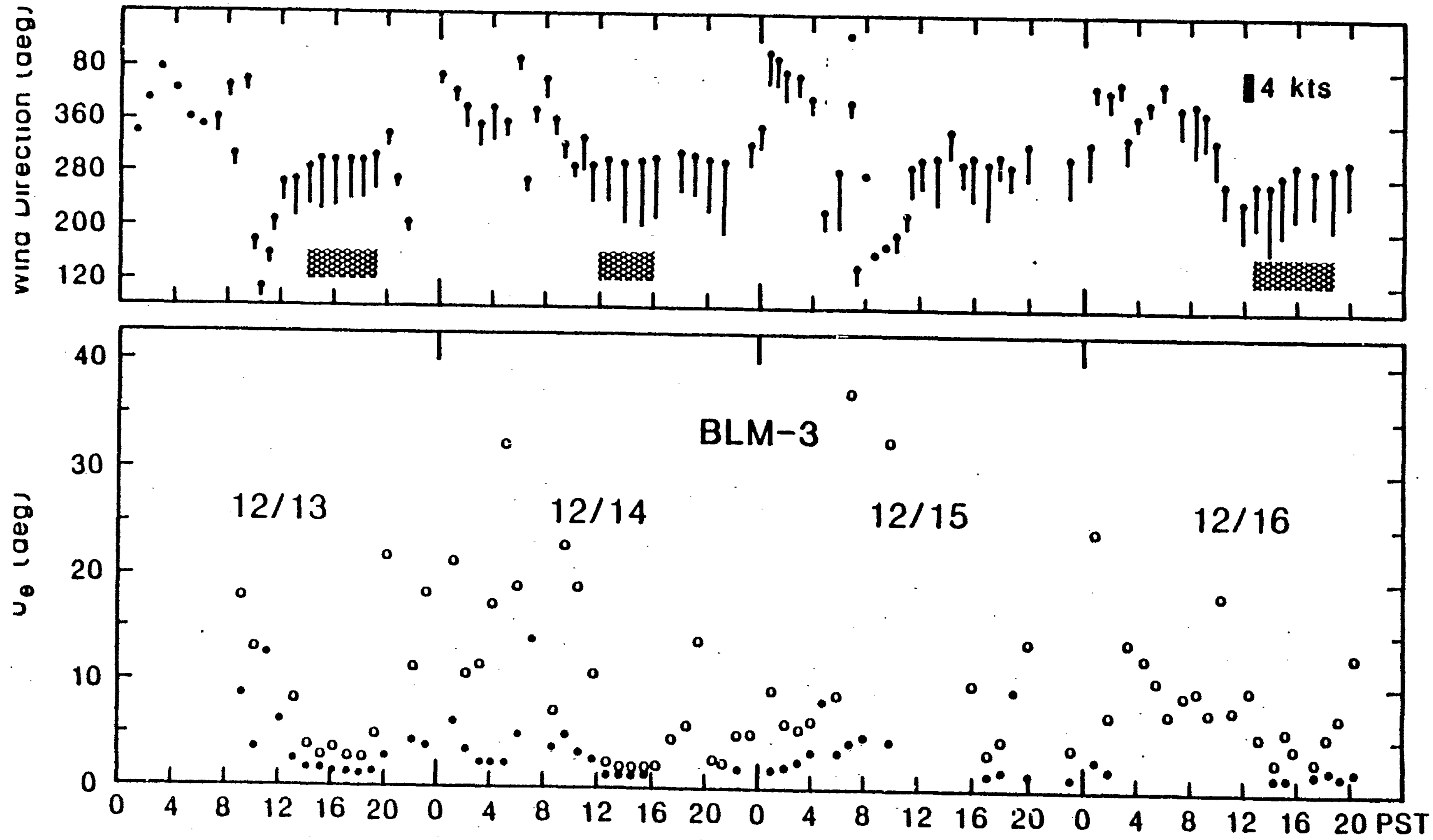


Figure 3. Wind speed, wind direction, and wind direction standard deviation as functions of time.

sub-sets are probably not available even with the large amount of data being used here. In order to determine the dependences on the individual parameters, one must look for self-consistency among the dependences found for various sub-sets when more than one parameter is a determining factor.

There are shipboard conditions which may cause some data to be more unreliable than others. These conditions are:

ship underway

poor relative wind direction

ship motion due to swells and waves.

Corrections for ship motion have been applied to these data and found not to be a significant factor. If the relative wind is from the stern of the ship, the data will be suspect. These data have been removed from the results. Having the ship underway while taking data should not be a problem unless significant additional ship motion is involved. Also, being underway allows one to keep the ship headed into the wind, which is an advantage. Thus, the only data we reject is for bad relative wind direction. We define bad to be for the direction within 40 degrees of the stern.

Dividing the data into the stationary and non-stationary wind regime is simple using Figure 3. By stationary we mean that the one-hour average wind direction remains constant within about 40 degrees and the wind speed is fairly constant. These criteria were used to determine stationarity, indicated by the dark bars on Figure 3. Note that stationarity only occurs when the wind is fairly strong and from a westerly to northwesterly direction.

Weak winds are marked by large meander.

The analyses will focus on dependences on the wind speed, convective mixing velocity, and stability, with inversion height and wind direction as important auxiliary paramenters. For illustrative purposes we include Figures 4-6 here to show the appearance of the data as functions of these parameters and how data for the various experiments compare. Not all of the data are shown in order to conserve space. Each of the figures, 4-6, show all of the 30 sec average data for each of the four experiments. The large variability that is normally present in fluctuation data is evident. Even though there is considerable scatter, trends in the data and that there is consistency between the various cruises are easily seen. In what follows we will use the term "variability" to mean the wind direction standard deviation.

The least wind direction variance occurs for BLM-1. This appears to be due to the conditions being more stationary during this experiment since those data were obtained almost exclusively when there was a well established onshore breeze. This restriction was not applied to the other experiments. For similar conditions, all experiments show the same results. This can be seen in Figure 7 where only data obtained during stationary periods are plotted.

Plots of the variability verses the convective mixing velocity divided by the wind speed, w_*/U, are shown in Figures 5 and 8. w_*/U is used because it is the natural buoyancy variable according to the theory presented in the former section. The

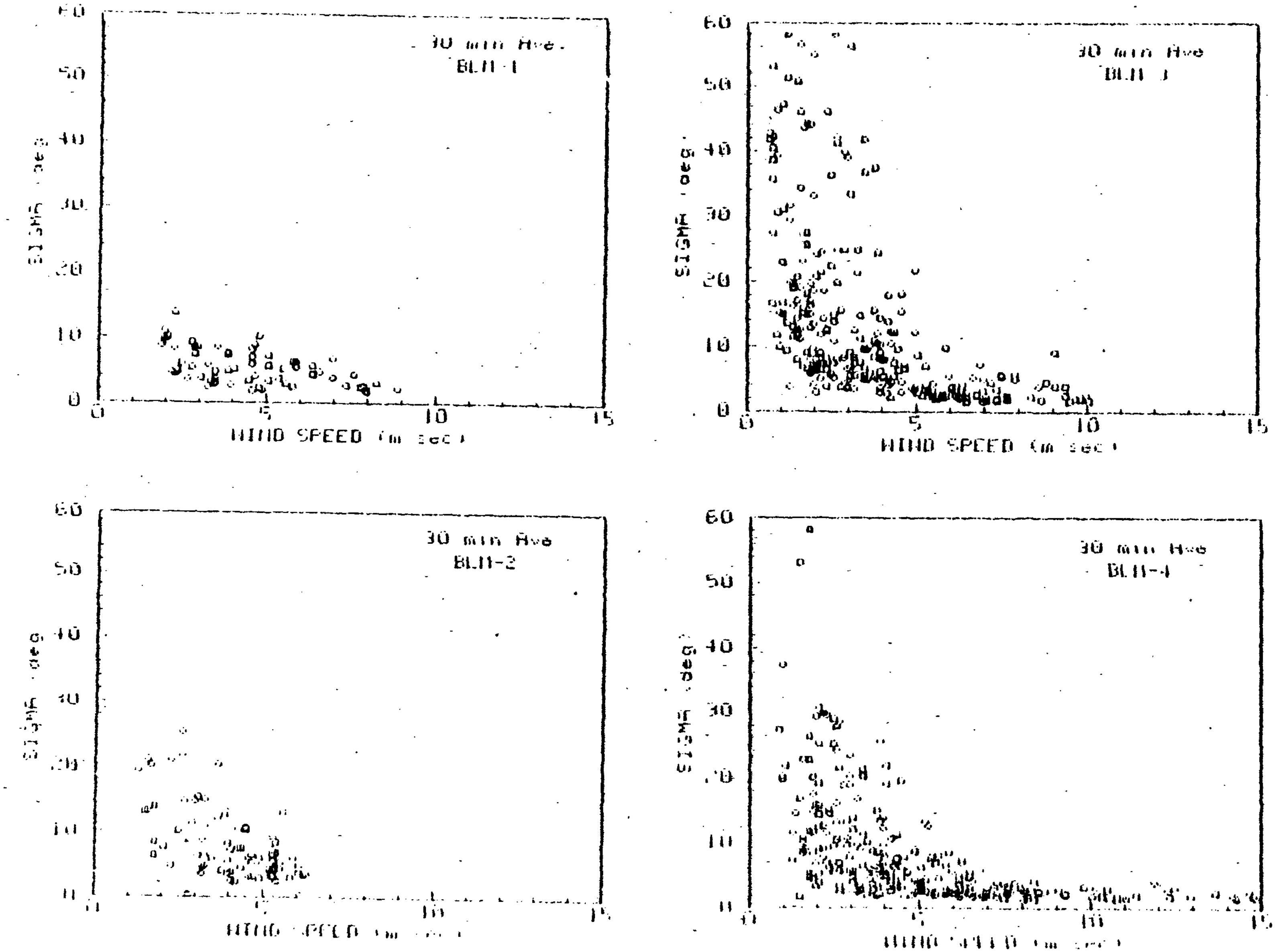
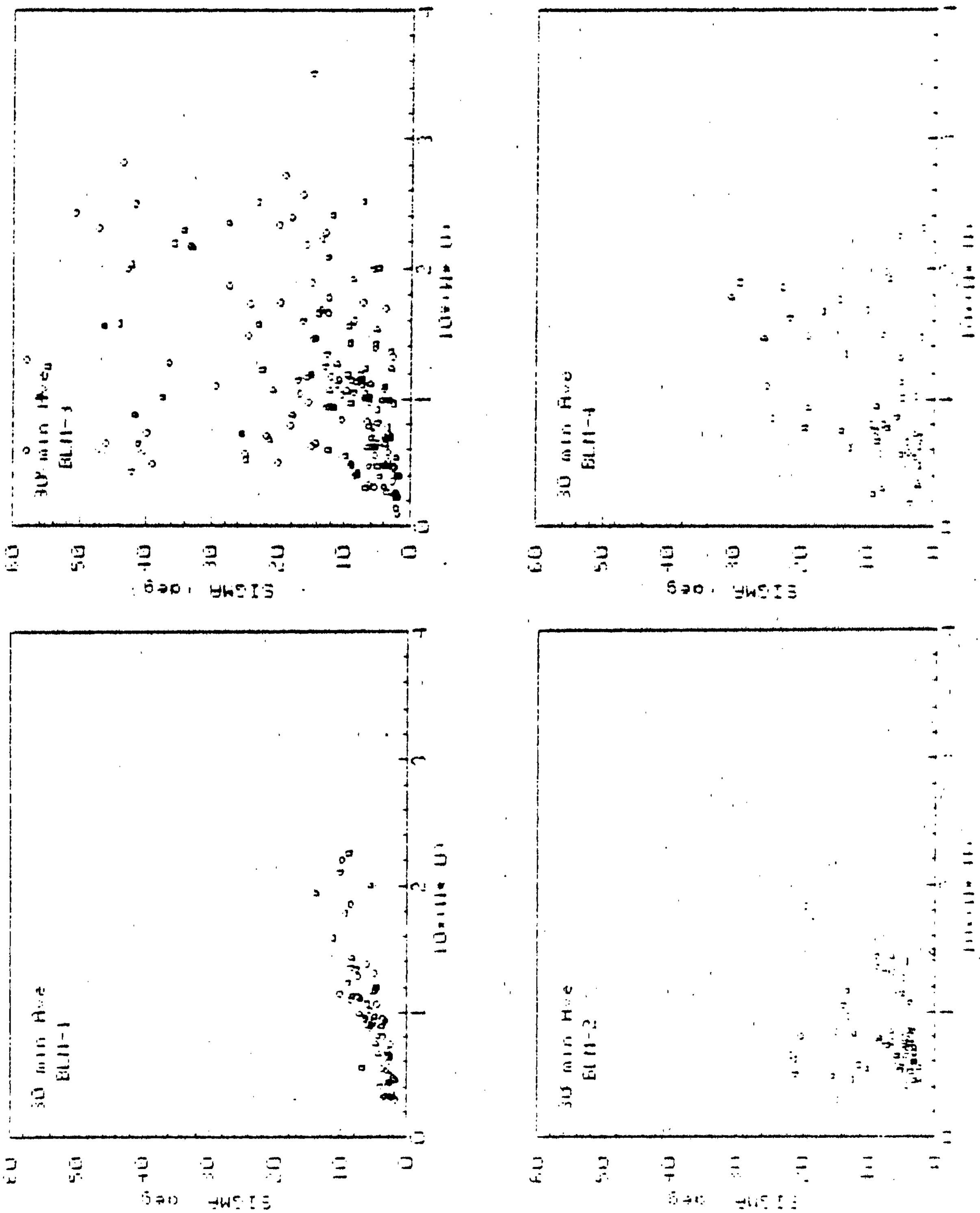


Figure 4. Dependence of wind direction standard deviation, 30 min averages, on wind speed.

Figure 5. Dependence of wind direction standard deviation, 30 min averages, on the ratio of the convective mixing velocity to the wind speed.



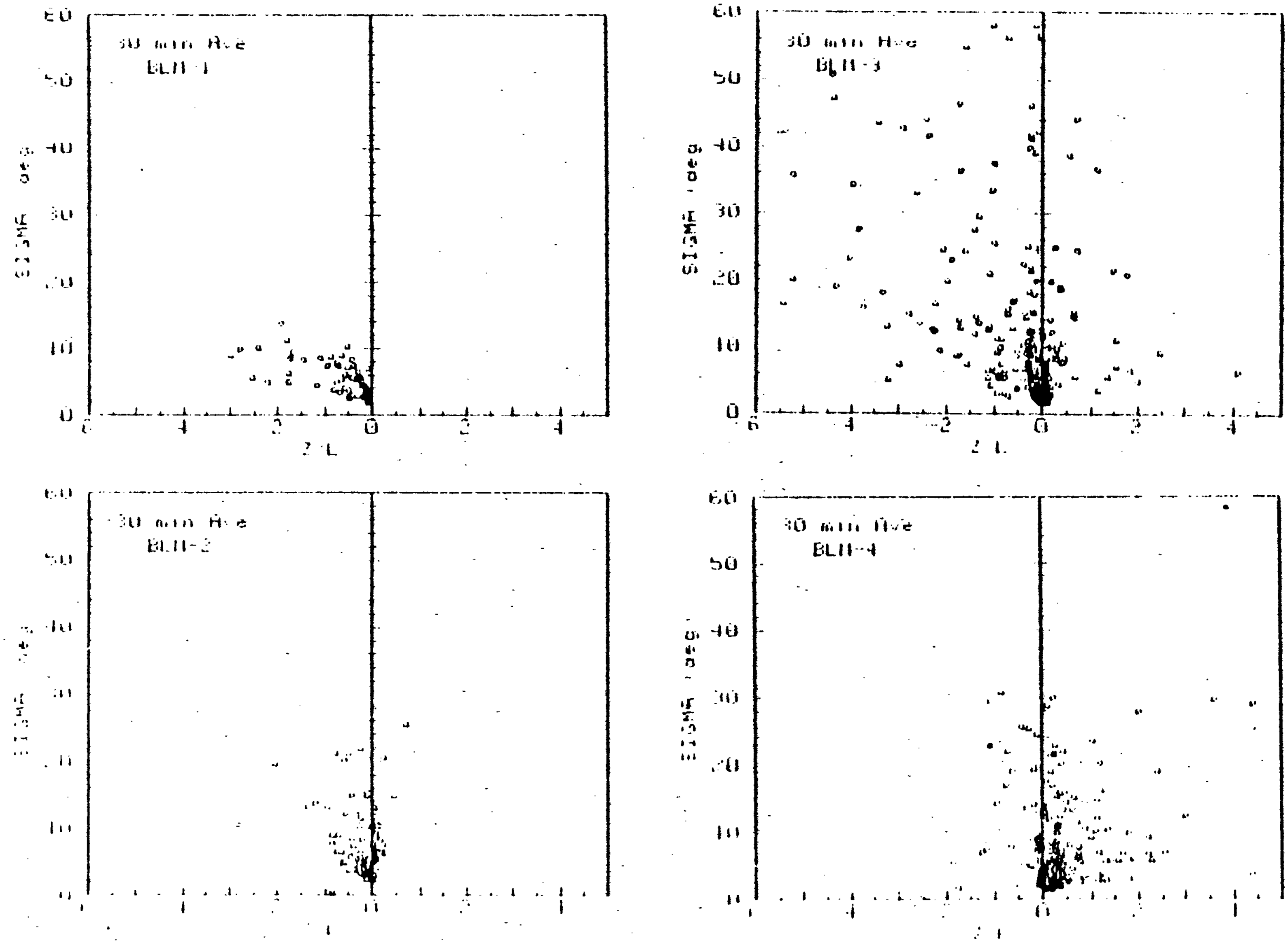


Figure 6. Dependence of wind direction standard deviation, 30 min averages, on the surface layer stability parameter.

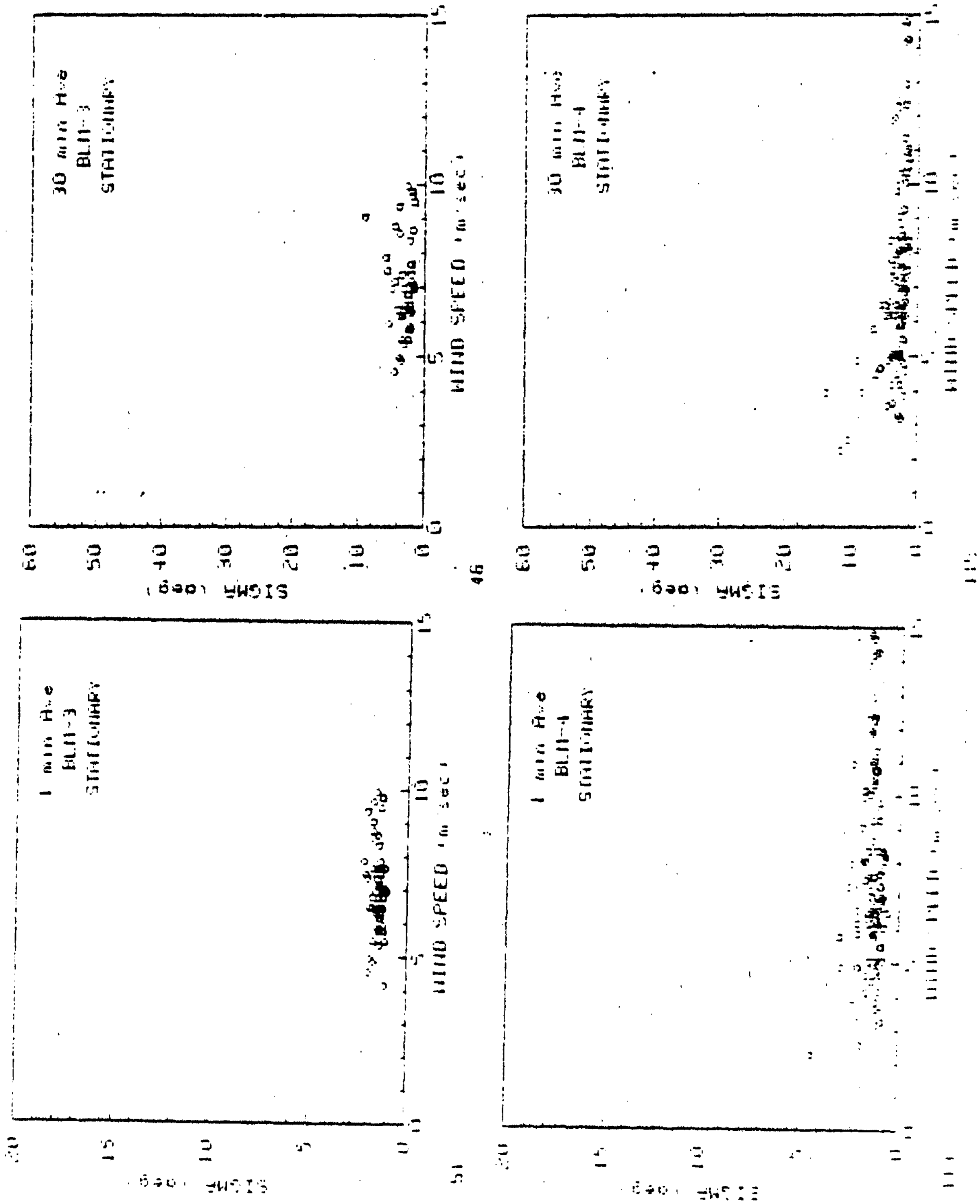


Figure 7. Dependence of wind direction standard deviation, 1 min and 30 min averages, on the wind speed for stationary conditions.

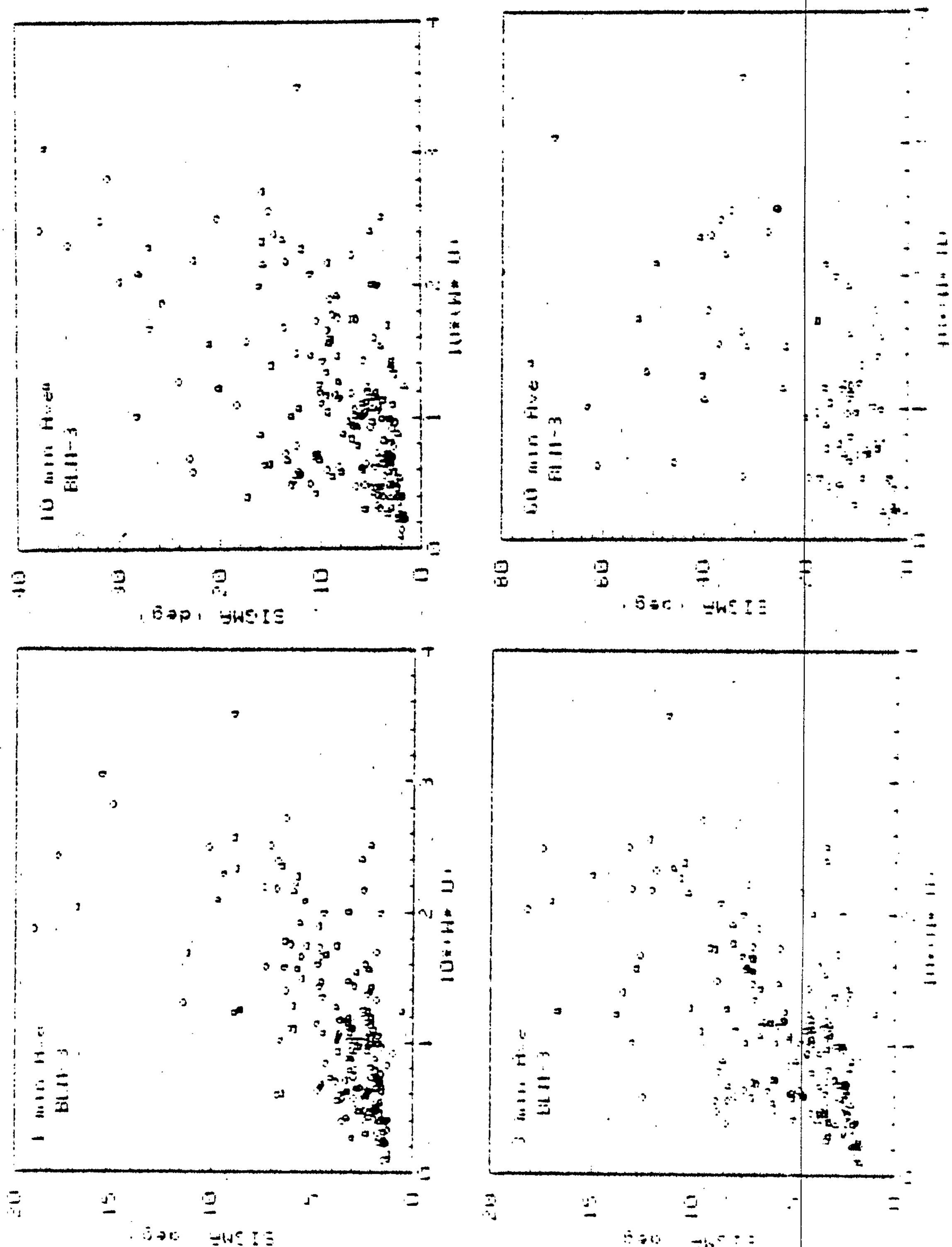


Figure 8. Dependence of wind direction standard deviation on the ratio of the convective mixing velocity to the wind speed for 1, 3, 10, and 60 min averaging times.

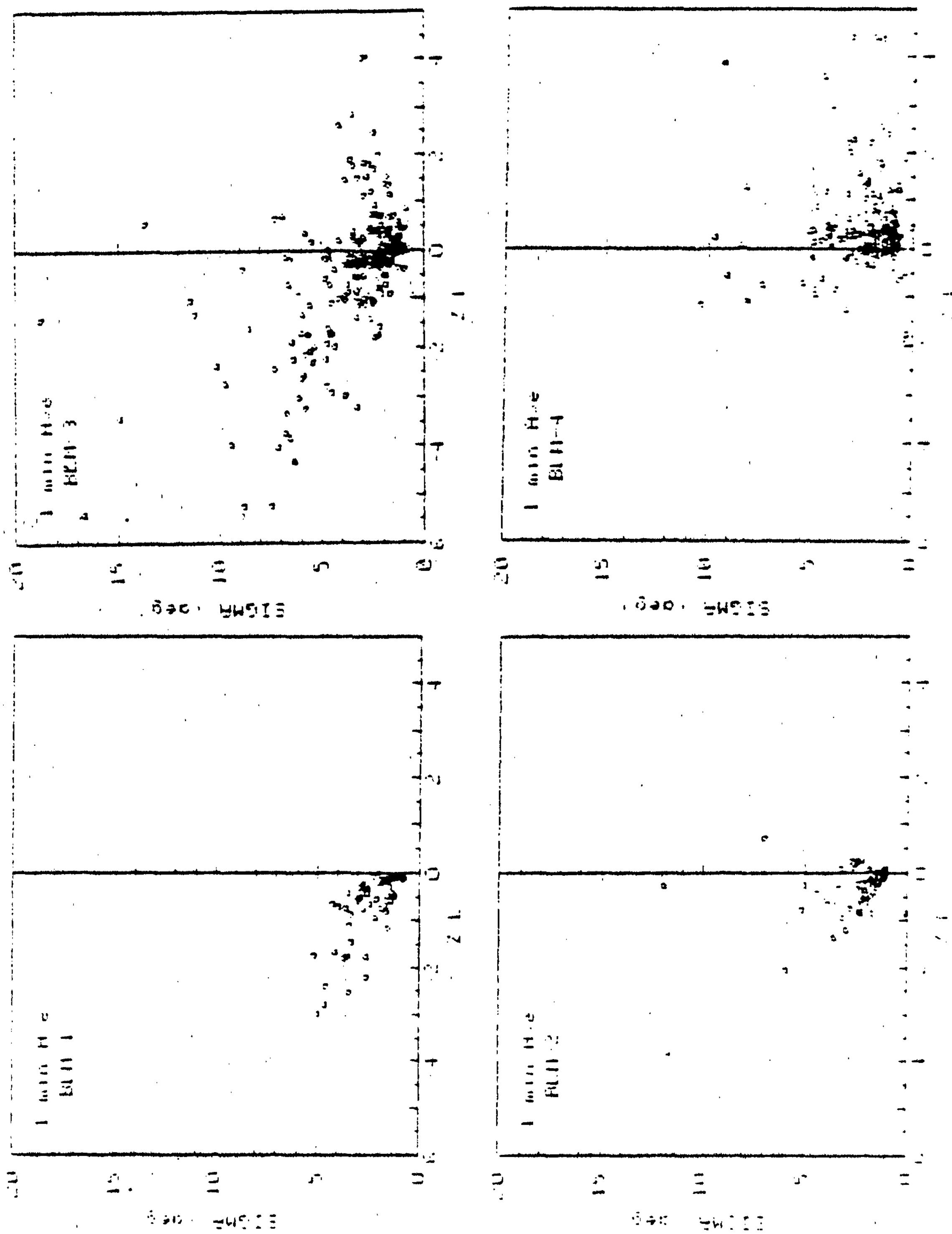


Figure 9. Dependence of wind direction standard deviation, 1 min averages, on the surface layer stability parameter.

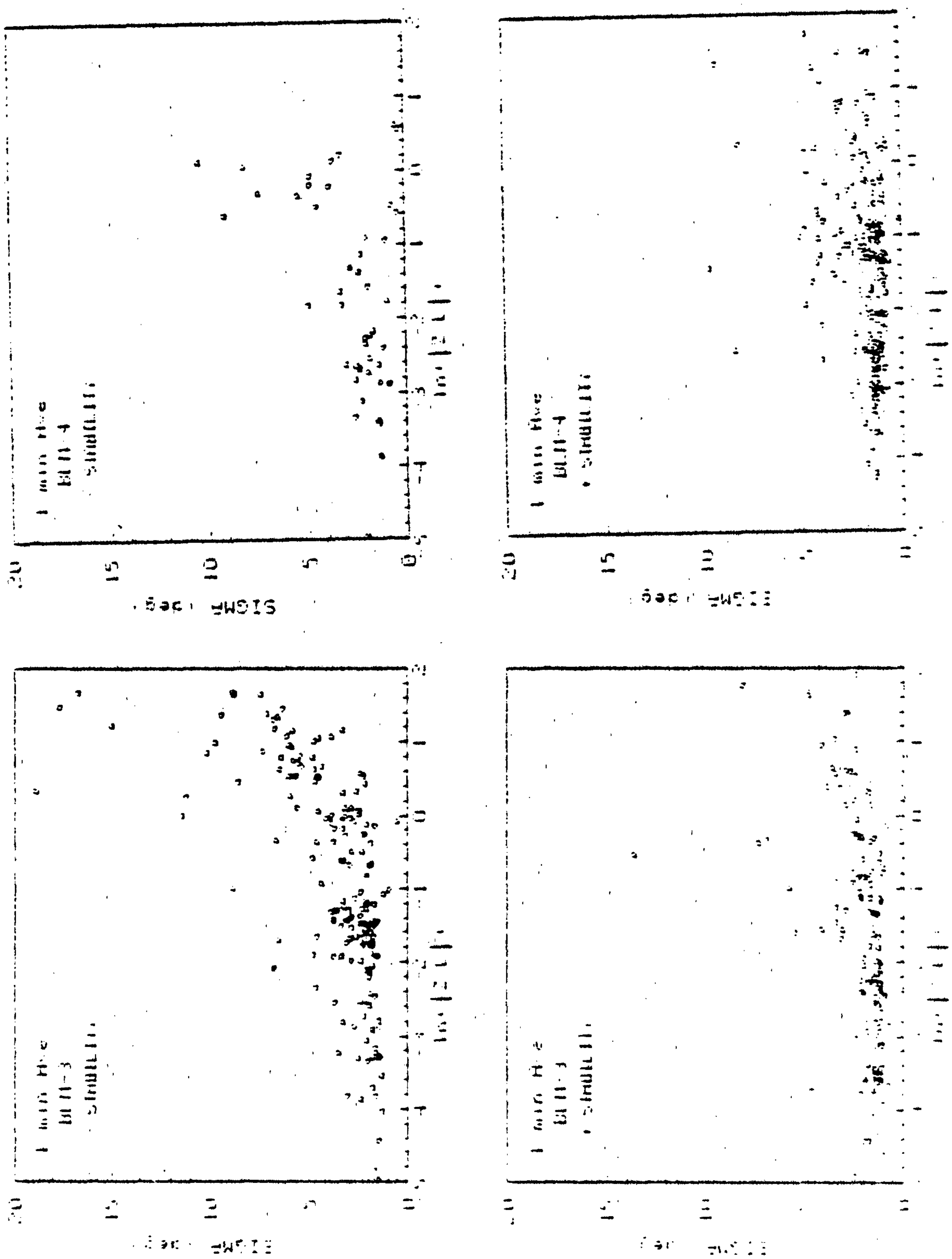
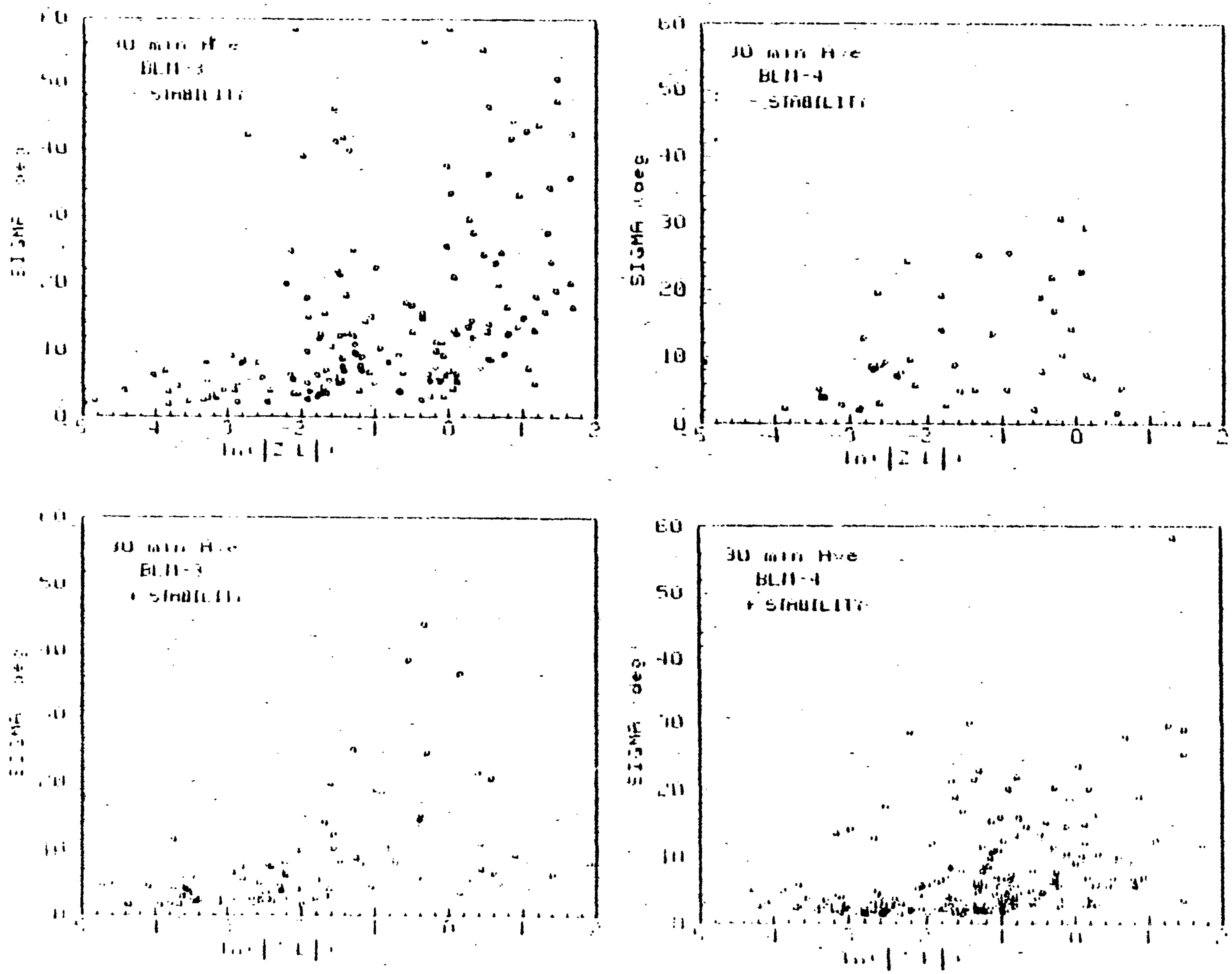


Figure 10. Dependence of wind direction standard deviation on the natural log of the absolute value of the surface layer stability parameter for stable and unstable conditions.



(Figure 10. - continued)

plots show a clear increase in variability with the parameter which suggests that convection plays a major role in turbulence production. As we shall see in what follows, the dependence shown is probably almost entirely due to dependence on the wind speed.

Whether convection plays a roll can also be determined by examining the dependence on stability. Dependences of wind variabilitiy on stability are shown in Figures 6 and 9. Figure 6 shows the 30 min and Figure 9 the 1 min average data for all experiments. One would expect the variability to be larger for unstable conditions, and there is a slight indication of this in the plots (eg. BLM-3, 1 min average). However, it would be difficult to draw any conclusions from these figures.

The range of stabilities encountered over water is small due to the small air-sea temperature differences that occur. Thus, stability dependence can be more easily seem from the dependence on ln(Z/L), using the absolute value of Z/L. Plots of this type are shown in Figure 10. The figure shows the 1 min and 30 min average data for unstable and stable conditions for BLM-3 and 4. For both averaging times it is apparent that a dependence on stability exists and that the turbulence is larger for unstable conditions, although the effect is small.

It is important to establish which are the dominant parameters to consider when developing the needed parameterization. Examples of how this was done are shown in the wind direction standard deviation versus wind speed plots presented in Figures 11-15. The parameters shown are

averaging time,

onshore/offshore flow,

stability,

w_*,

Z_i.

Averaging time obviously is an important parameter, which is confirmed in Figure 11. There is about a 4-fold increase in variability for a change in averaging time from 1 min to 60 min.

There is no apparent difference in the turbulence seen for onshore and offshore conditions, Figure 12.

We already discussed the dependence on stability. Figure 13 shows that the dependence is weak, only being marginally apparent when plotting the dependence on wind speed.

The weak dependence on stability leads us to reexamine the dependence on the convective mixing velocity, w_*. As was discussed above, Figures 5 and 8 show strong dependences on w_*/U. If this were due to w_* dependence, turbulence during stable conditions should be considerably less than during unstable because convective activity is absent. This is not the case. We examine this further by sorting the data into cases where $w_* <$ 0.1 m/sec and cases for which it is greater. These data are shown in Figure 14 for BLM-2 and 3. No apparent dependence on w_* is seen. Finally, we have plotted the dependence on w_* directly in Figure 15, for all experiments, for 30 sec averages. Again, any dependence on w_* is masked by other effects although BLM-1 does show a possible trend for those mostly stationary conditions. In the next section we show a method for determining

this weak contribution due to buoyancy production.

Since shear produced turbulence goes to zero at low wind speeds, the source of the large wind direction variability at low speeds must be another mechanism. Our original explanation was that the source is buoyancy but, as can be seen from the discussion immediately above, this seems not to be the case. Figure 15 does show that there is some w_* dependence for BLM-1 (turbulence was weak) and recall that mostly stationary conditions were encountered for that experiment. Thus, the large values of variability at low wind speed are associated with non-stationary conditions. Non-stationarity occured during transition periods associated with the land-sea-breeze cycle. The forcing for the cycle is differential heating between the land and the sea, which is a mesoscale process. In what follows we will refer to the low wind speed turbulence produced by other than buoyancy as "mesoscale" production. No more definitive description of this process is possible from these data.

The above discussion suggests that it may be possible to observe the dependence on w_* during stationary conditions when mesoscale forcing is weak. Figure 16 shows data for stationary conditions, for 1 min and 30 min averages, for BLM-1 and BLM-3. BLM-2 and BLM-4 are not shown because the coincidence of stationarity and unstable conditions (w_*=0 for stable conditions) seldom occured for those experiments. Note, the scales have been changed in these plots because the turbulence is much weaker for stationary conditions. It is apparent from Figure 16 that there is a weak dependence on w_*. We will use stationary conditions to

examine w_* dependence in the following section.

The other parameter we wish to discuss specifically is the mixing depth (inversion height, Z_i). As we indicated in the theory section, one can include a supression factor that depends on Z/Z_i in the shear production term. We feel that this factor should not be included for turbulence in the surface layer, which is where these data were obtained. If the factor is important, it would be felt for low inversion heights. Fortunately, there were wide ranges of inversion heights during BLM-2 and 3, with some very low inversions. We have sorted into cases where the inversion was lower than 50m and cases where it was higher, and present these results in Figure 17. 50m is a very low inversion and its effects should be strongly felt if the suppression factor is appropriate. Figure 17 shows no effect so we assume that factor should not be included in what follows.

It is difficult to obtain quantitative information from scatter plots of the type we have discussed in this section. They are mainly useful for identifying trends. In the next section we present averaged data, which are used for fitting theory to experiment. We have used the general results discussed above to guide the subsequent analyses.

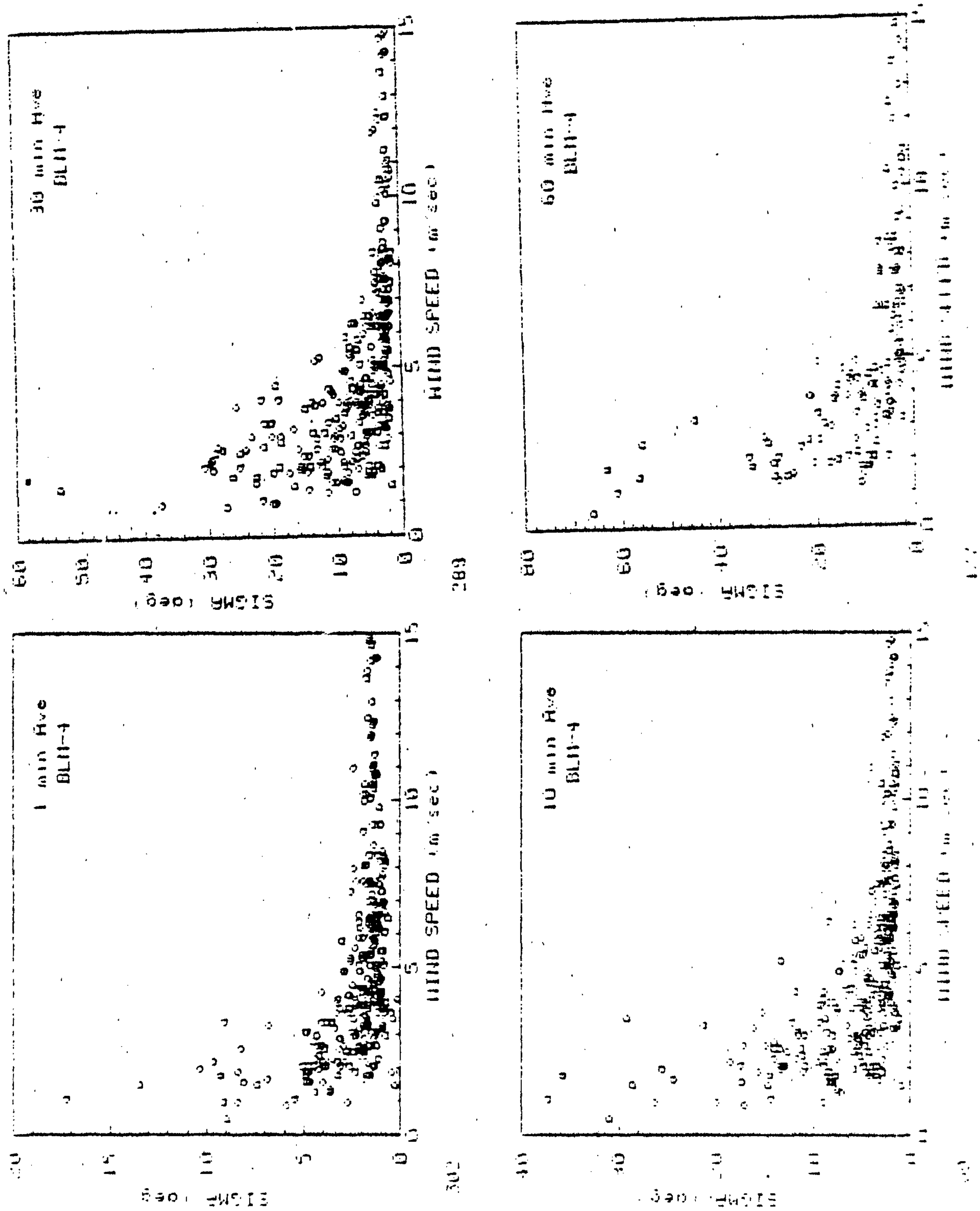
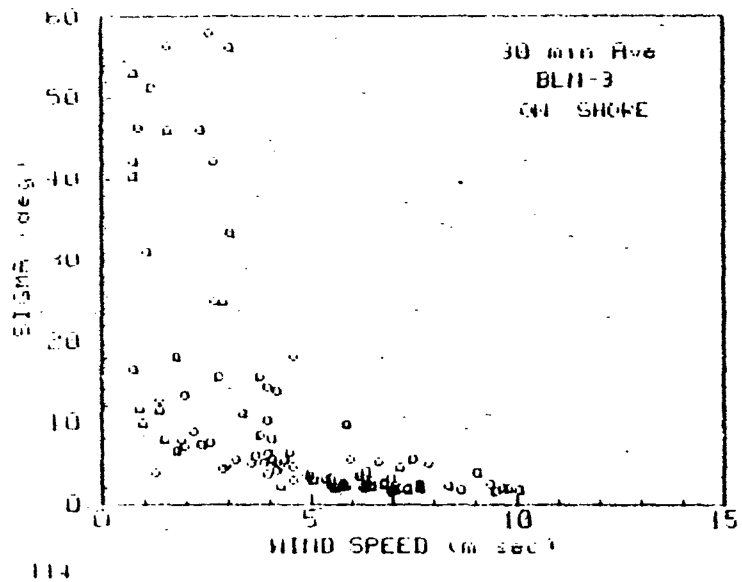
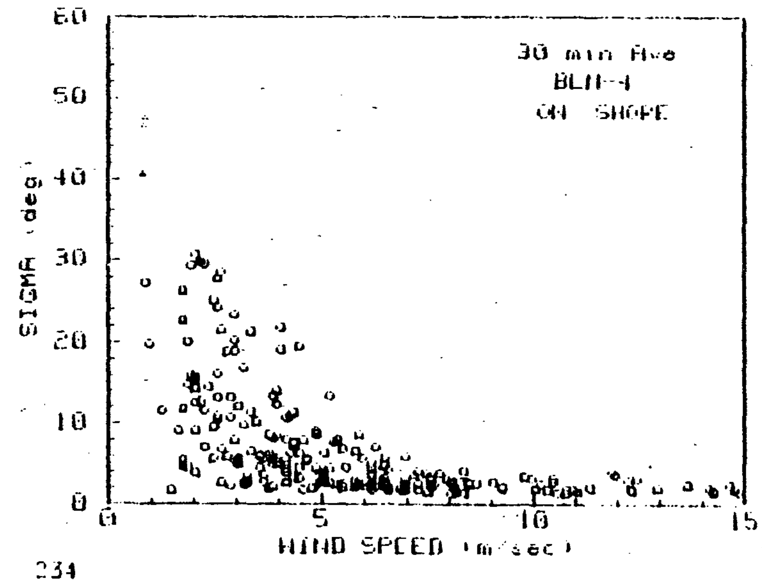


Figure 11. Dependence of wind direction standard deviation on wind speed for averaging times of 1, 10, 30, and 60 min.





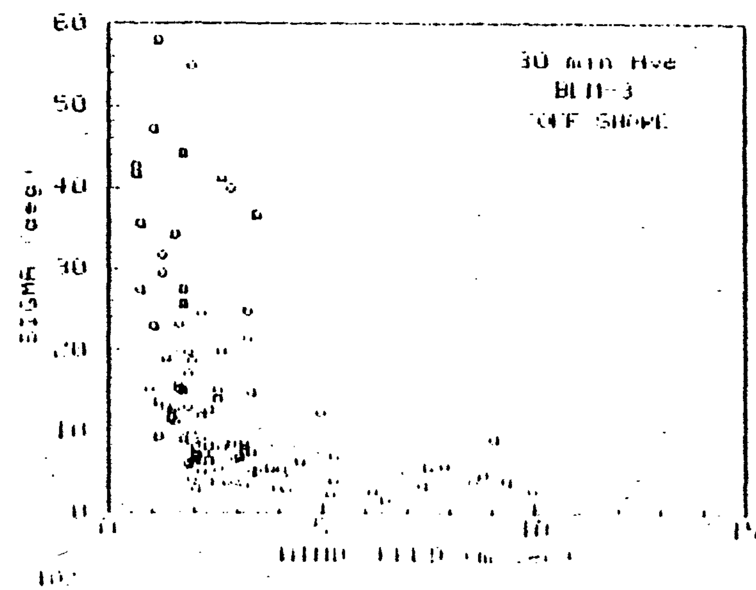


Figure 12. Dependence of wind direction standard deviation, 30 min averages, on wind speed for onshore and offshore flow conditions.

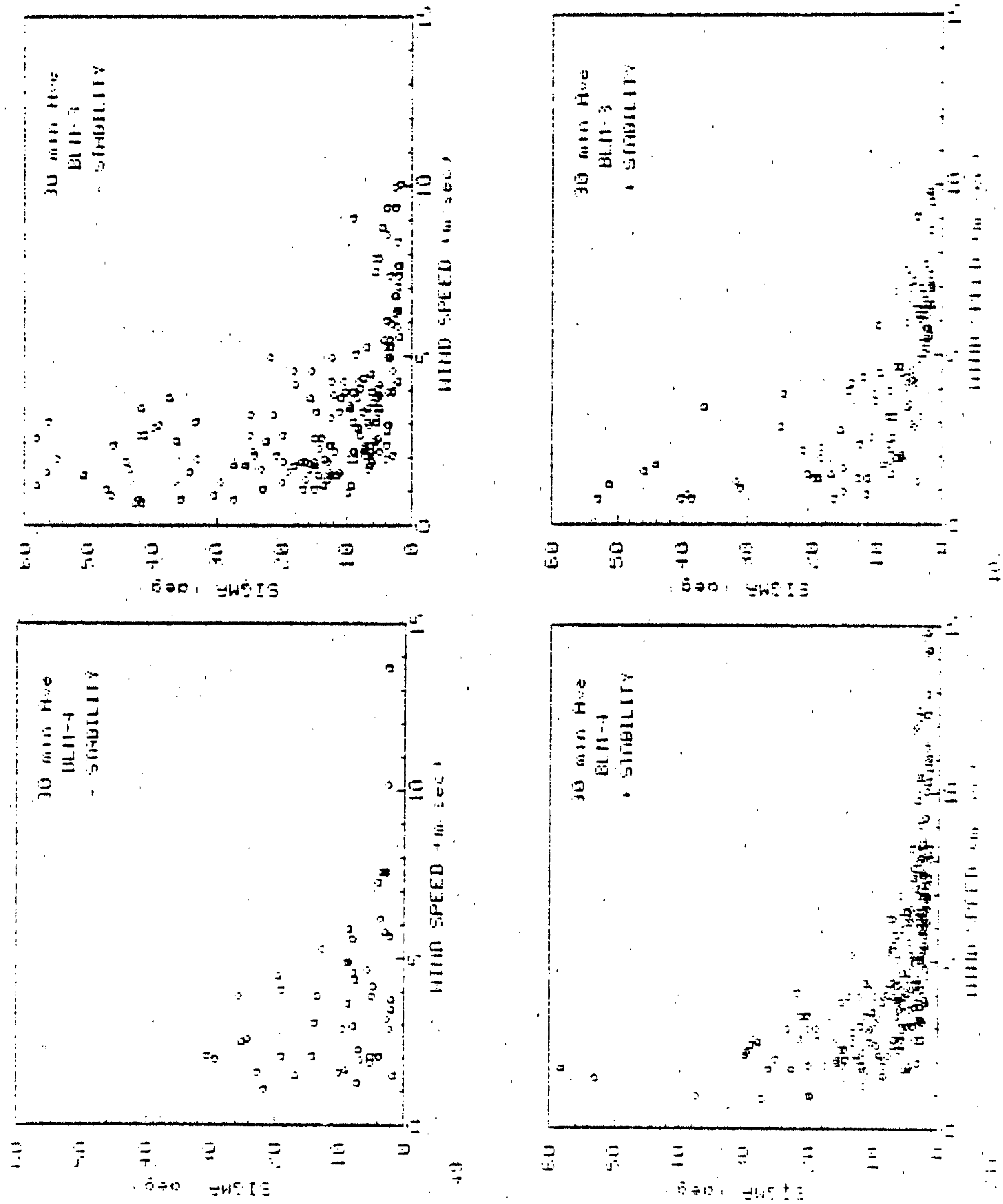
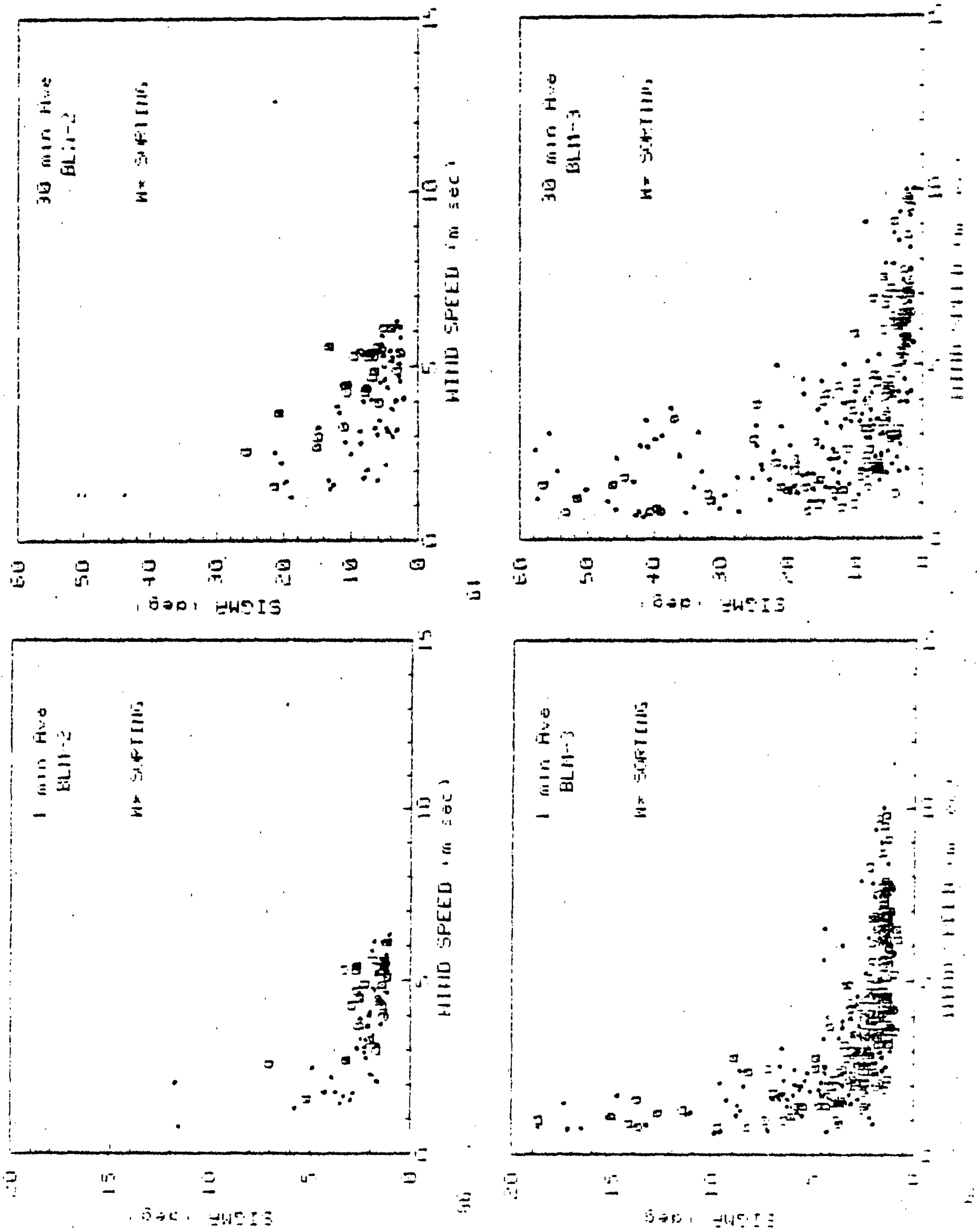


Figure 13. Dependence of wind direction standard deviation, 30 min averages, on wind speed for unstable and stable conditions.

Figure 14. Dependence of wind direction standard deviation, 1 min and 30 min averages, on wind speed. The data is sorted into cases with the convective mixing velocity below, circles, and above, dots, 0.1 m/sec.



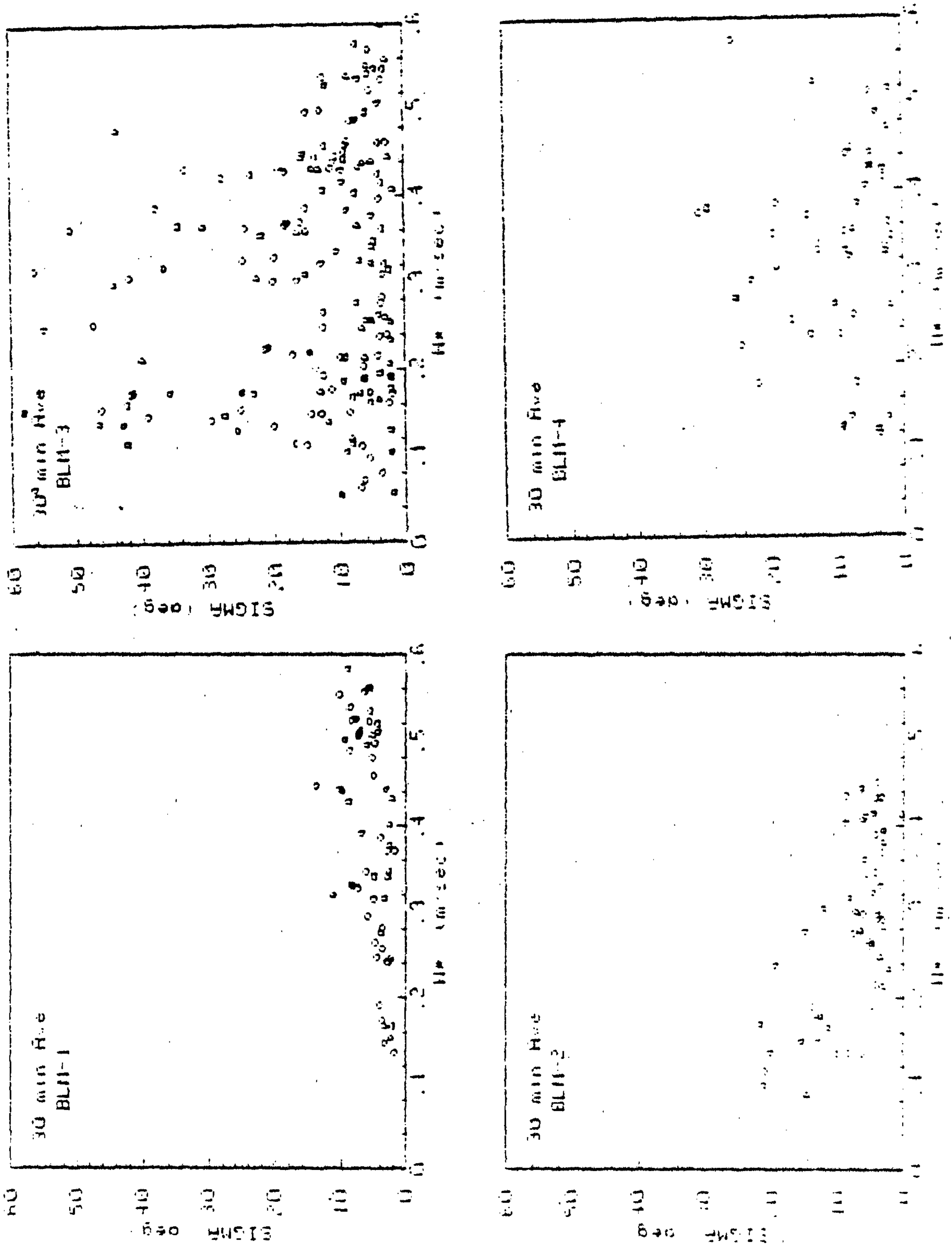


Figure 15. Dependence of wind direction standard deviation, 30 min averages, on convective mixing velocity.

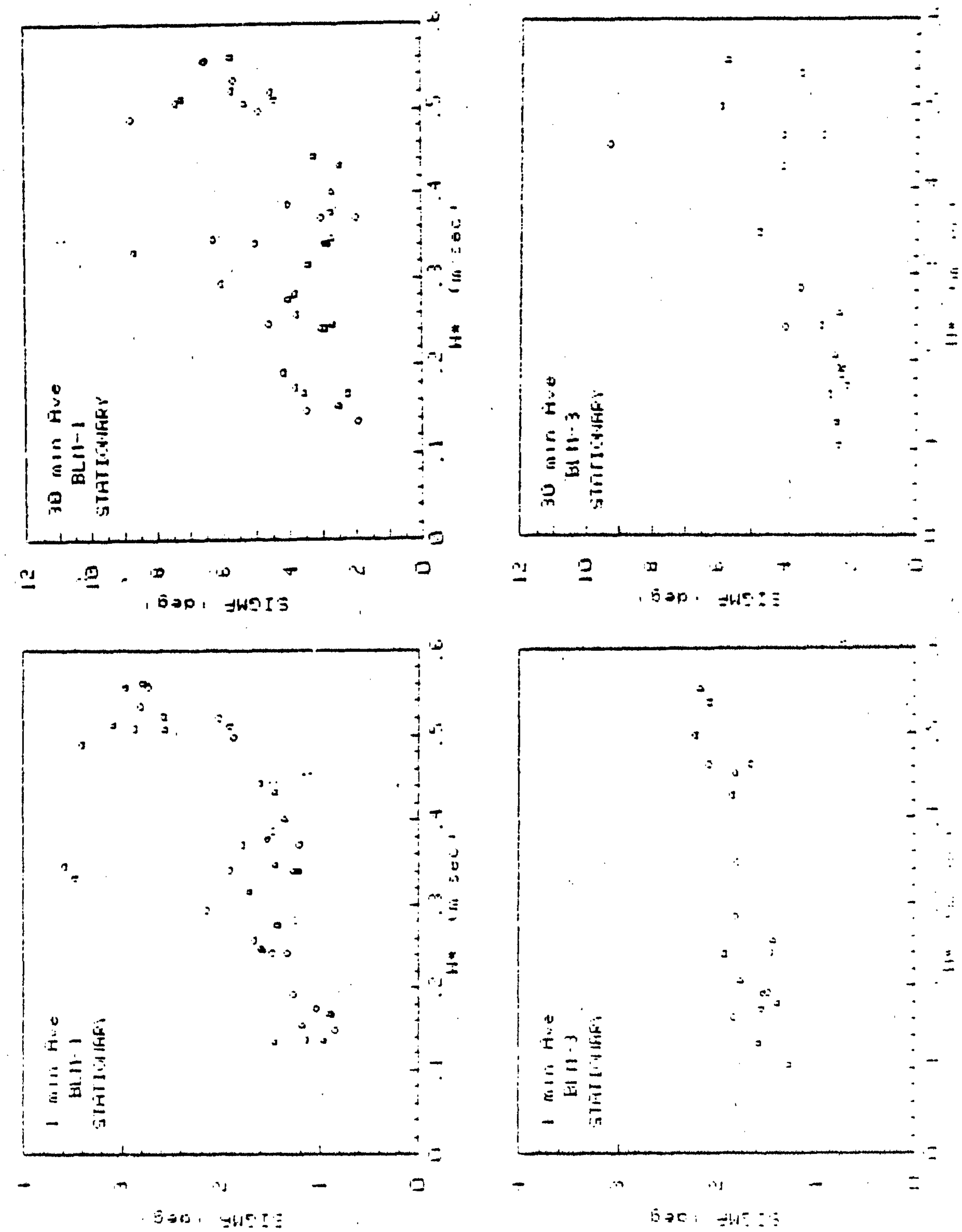


Figure 16. Dependence of wind direction standard deviation on the convective mixing velocity, BLM-1 and BLM-3, 1 and 30 min averages, stationary conditions.

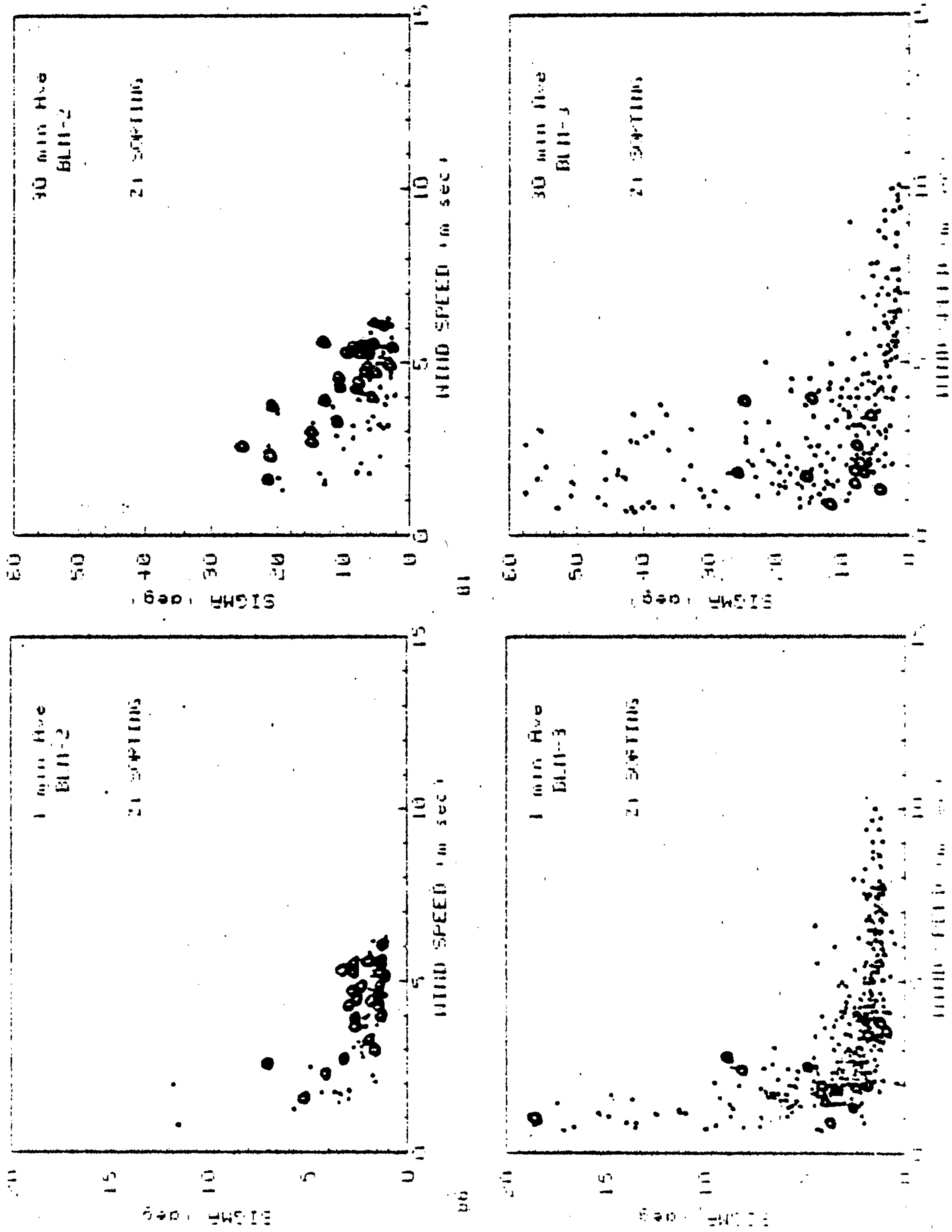


Figure 17. Dependence of wind direction standard deviation, 1 min and 30 min averages, on wind speed. The data is sorted into cases with the mixing depth less than, circles, and above, dots, 50m.

VII. PARAMETERIZATION ANALYSES

The various presentations of the data in the previous section allow some conclusions to be drawn about the mechanisms driving horizontal wind variability and the methodologies needed to determine the correct parameterization. Three mechanisms can be identified from the data, buoyancy and shear production as expected and a larger scale forcing, which we associate with mesoscale processes. The following association between these production mechanisms and conditions can be used to separate the processes for purposes of developing the parameterization.

Shear production: Dominates at high wind speed, insignificant at low

Buoyancy: Absent for stable conditions, decreases as 1/U

Mesoscale: Largely absent during stationary conditions

In the analyses that follow we average all data that falls within various ranges of the parameter being examined. This leads to considerable smoothing of the results, as can be seen in Figures 18. The upper graphs in Figures 18 show the average σ vs. wind speed results for all four experiments, with data points plotted using a number that indicates the experiment. The lower graphs show results averaged over all of the experiments, which is the form used for the following parameterization analyses. The first graphs show the degree of consistency that exists in the data

and is therefore useful as an indicator of the quality of the results.

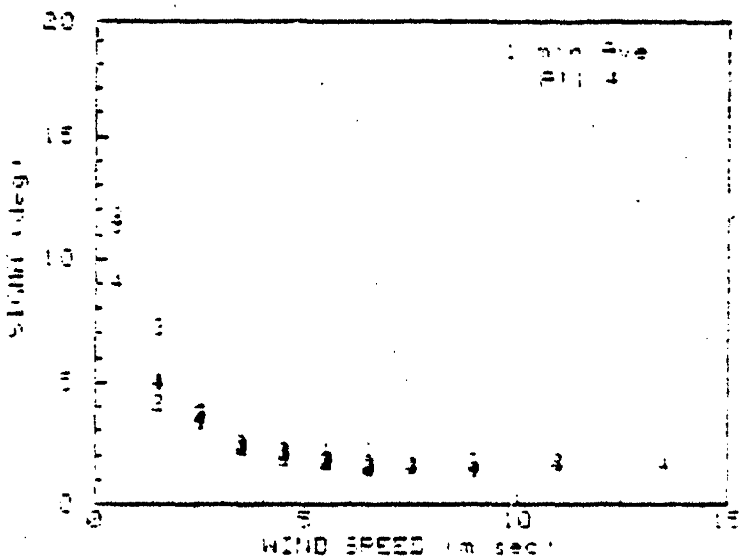
The figures also contain a print out of the results averaged over all data, giving: the value of the parameter for the center of that range, the number of points found in that range, the mean standard deviation of the horizontal wind direction over the averaging period indicated (sigma), and the standard deviations of the data about the mean sigmas.

Each set of graphs in what follows contains captions indicating the meteorological conditions, averaging time, and experiment during which the data was taken (total is the average over all experiments).

Figures 18 show σ vs. U, using the format described above, for averaging times from 1 to 60 min. The consistency between the results for the various cruises is good, with a minor inconsistency occuring for BLM-1 at low wind speeds. This effect may be real because, as noted in the previous section, conditions when data were obtained for BLM-1 were somewhat more stationary than for the other experiments. The graphs indicate that it is appropriate to average over all cruises for the analyses, which was the method used.

The most difficult task is to seperate the weak buoyancy dependence from the large contribution being made by mesoscale processes. We do this in two ways. One is to determine the differences in results for stable and unstable conditions. The other is to determine the dependence on w_* for stationary conditions where the large scale meander is mostly absent. The

remainder of this section will be divided into subsections, each dealing with a specific analysis and presenting the data used and results for that analysis.



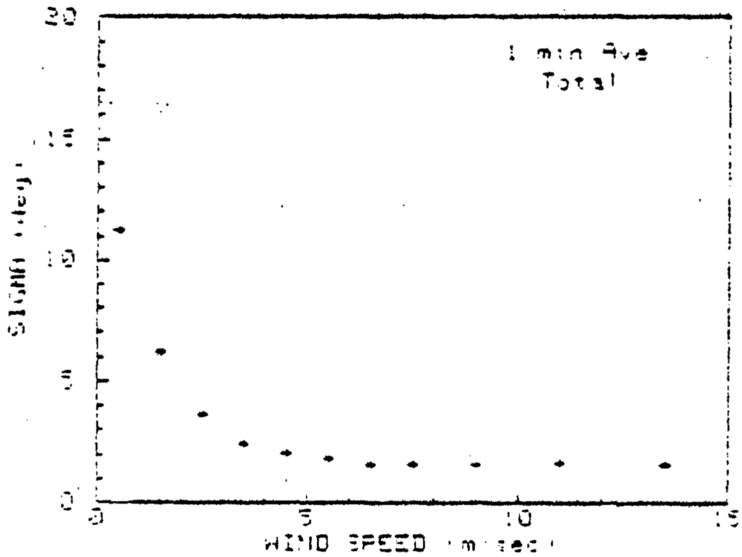
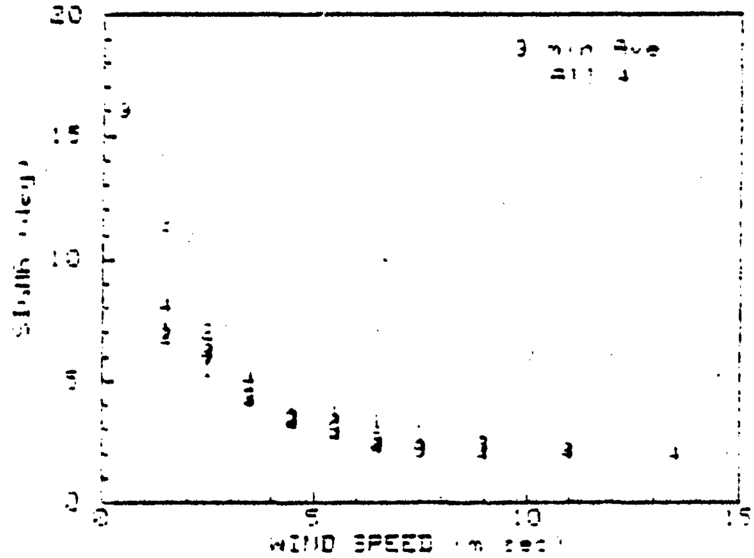
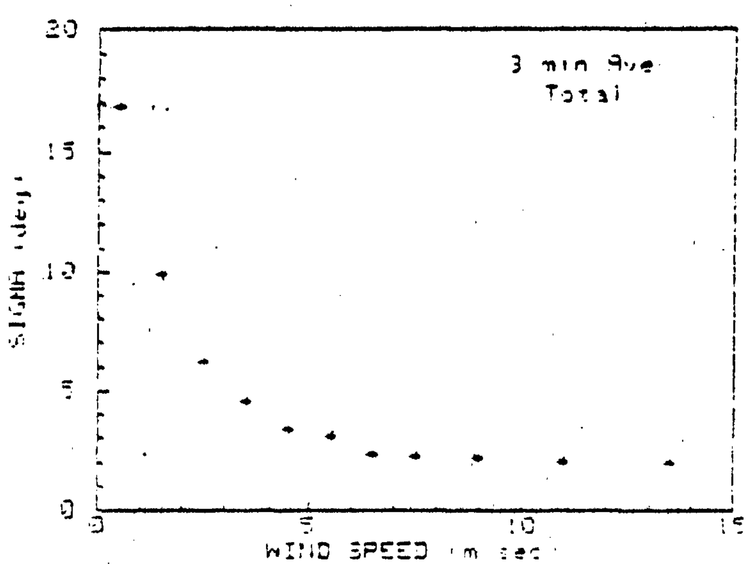


Figure 18. Means over wind speed ranges of the standard deviations (sigma). Upper plot has means for each experiment, lower plot means over the total data set. The standard deviations of the data about the means are given in the table.

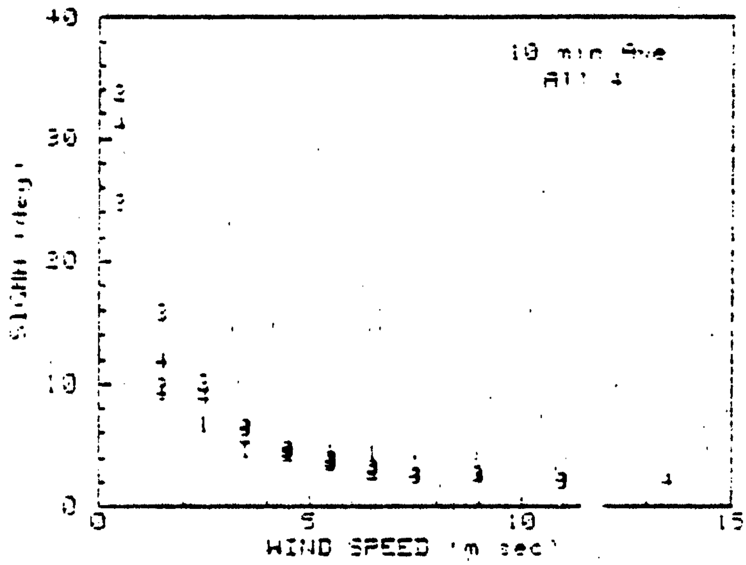
U	#	SIGMA	Std Dev
.5	14	11.2	5.8
1.5	34	6.2	4.2
2.5	109	3.6	2.0
3.5	121	2.4	1.2
4.5	125	2.0	.8
5.5	99	1.8	.7
6.5	58	1.6	.5
7.5	49	1.5	.4
9.0	34	1.5	.4
11.0	[illegible]	1.5	.2
13.5	14	1.5	.1

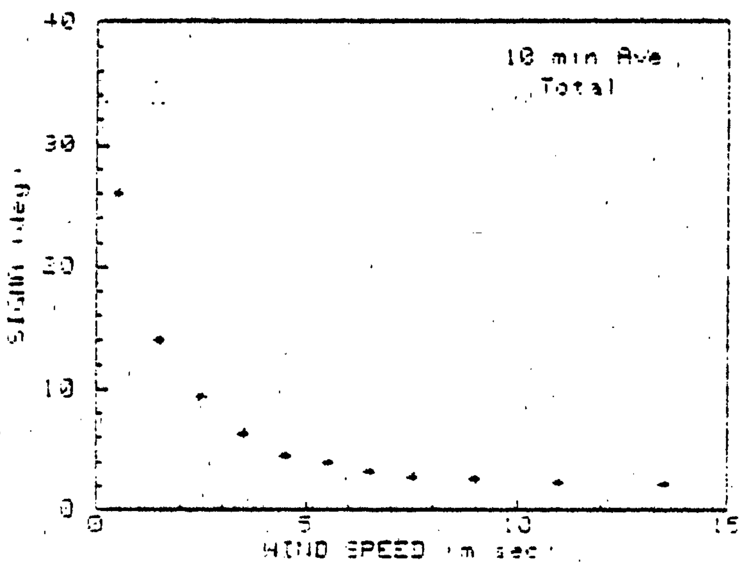




U	#	SIGMA	Std Dev
.5	14	16.8	3.5
1.5	84	9.9	6.3
2.5	139	6.1	2.5
3.5	122	4.5	4.1
4.5	128	3.4	1.6
5.5	38	3.0	1.4
6.5	57	2.3	.9
7.5	48	2.2	[illegible]
9.2	24	2.2	.6
[illegible]	[illegible]	2.0	.5
[illegible]	[illegible]	2.0	.2

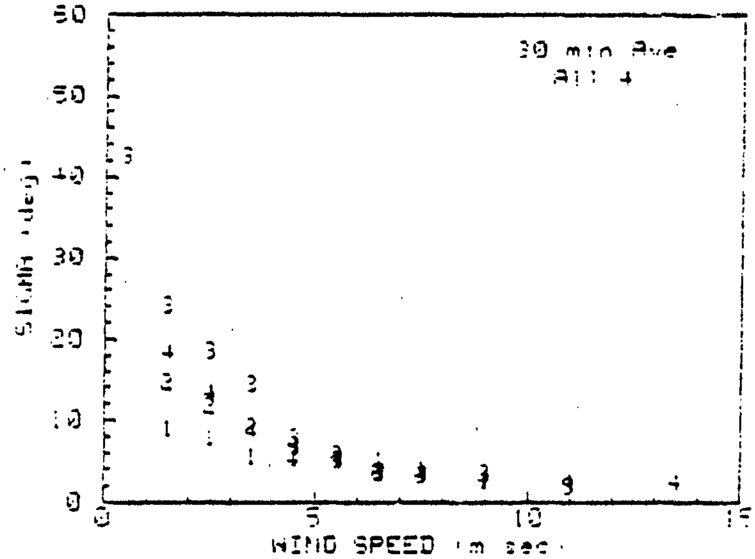
(Figure 18. - continued)

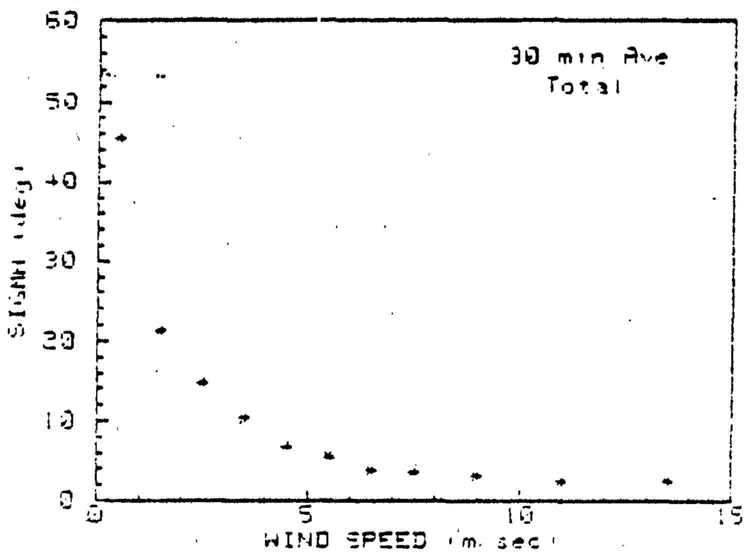




U	#	SIGMA	Std Dev
.5	14	25.9	10.9
1.5	94	14.0	10.[illegible]
2.5	139	9.4	7.0
3.5	130	6.2	4.5
4.5	125	4.5	2.4
5.5	[illegible]	[illegible]	[illegible]
6.5	58	[illegible]	[illegible]
7.5	43	[illegible]	1.0
9.0	34	[illegible].5	.3
[illegible].0	[illegible]	[illegible]	[illegible]
[illegible].5	[illegible]	[illegible]	[illegible]

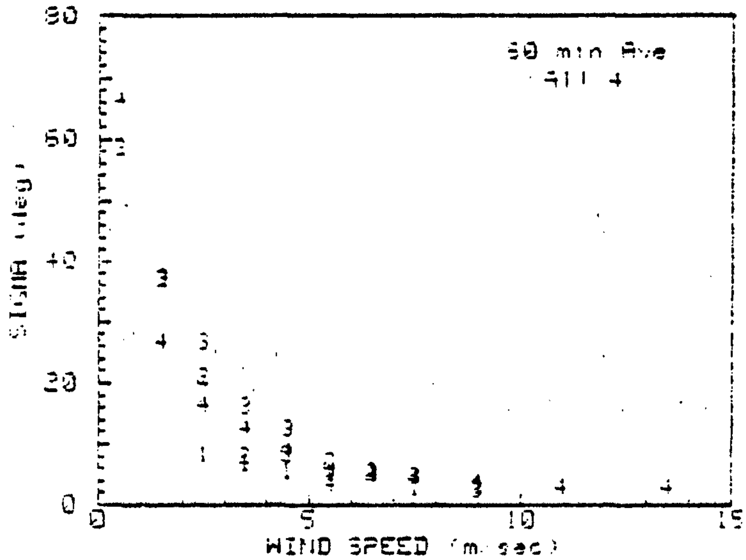
(Figure 18. - continued)

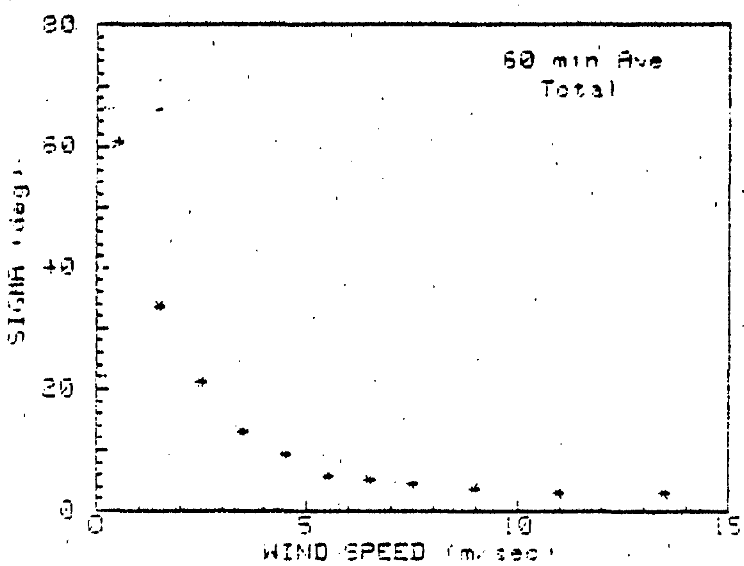




U	#	SIGMA	Std Dev
.5	13	45.6	21.2
1.5	83	21.1	16.6
2.5	120	14.7	12.0
3.5	115	10.4	9.2
4.5	104	6.9	3.9
5.5	81	5.3	3.3
6.5	57	3.7	1.4
7.5	42	3.4	1.2
9.0	33	2.8	1.4
11.0	16	2.3	.9
13.5	13	2.2	.5

(Figure 18. - continued)





U	#	SIGMA	Std Dev
.5	4	60.5	15.5
1.5	43	33.5	22.7
2.5	56	21.1	15.3
3.5	59	12.9	10.4
4.5	49	9.4	5.1
5.5	27	5.5	3.8
6.5	24	5.0	3.5
7.5	20	4.4	2.0
9.0	15	3.5	1.4
11.2	6	3.3	1.4
13.5	6	3.0	.9

(Figure 18. - continued)

MESOSCALE AND SHEAR PRODUCTION,

σ_Θ vs. U, STATIONARY AND NON-STATIONARY CONDITIONS

The contribution to the variability made by mesoscale processes is determined by comparing data for stationary and non-stationary conditions. The shear production contribution is determined from stationary, stable conditions. Plots of stationary and non-stationary data are presented in Figures 19 and in Figures 20 for stable conditions.

Shear production is dominant at high wind speeds. Mesoscale forcing will be largely absent for stationary conditions and buoyancy production absent for stable conditions . Thus, we average the high wind data (the three highest speeds) from Figures 20 to obtain the shear production contribution. The results are given in the following table.

T_{ave}(min)	$\langle\sigma_\Theta\rangle$(deg)
1	1.5
3	1.9
10	2.1
30	2.5
60	3.0

Table 3. Mean wind direction standard deviations for high wind speed (>9 m/sec), with stable and stationary conditions.

Differences in the variability for stationary and non-stationary conditions will yield only an estimate of the mesoscale contribution because it is not true that this contribution is absent during the times we judge to be stationary, only that it is considerably less. Thus, the procedure will tend to underestimate the contribution. Also, combining data for stable and unstable conditions (Figures 19), mixes results for various values of w*; if the mean w* are not the same for stationary and non-stationary conditions a small error will be introduced.

Of course, the shear production term must also be removed from the data in order to isolate the mesoscale production. This occurs automatically when subtracting stationary and non-stationary results. It is also possible to obtain a good estimate of mesoscale production by subtracting the shear production contribution from the non-stationary, stable results. This method has the advantage that it gives results at low wind speeds, which cannot be done when stationary data, which exists only at higher wind speeds, is used. In order to do this, the shear contribution at all wind speeds must be known.

We have measures of shear production at about 11 m/sec presented in Table 5. We can use the second term of Equation 20,

$$\sigma_\theta^{2}(\text{shear}) = C_U\, F(L)(7.5\text{x}10^{-4} + 6.7\text{x}10^{-5}U), \qquad (23)$$

to estimate the shear contribution over a range of wind speeds. This has been done and the results are presented in the following

table. We assume F(L)=1.0 .

T_{ave}	C_{II}	U= 0	3m/sec	7m/sec	11m/sec	15m/sec
		σ_θ(deg) for				
1	0.46	1.1	1.2	1.4	1.5	1.6
3	0.74	1.3	1.5	1.7	1.9	2.1
10	0.90	1.5	1.7	1.9	2.1	2.3
30	1.28	1.8	2.0	2.3	2.5	2.7
60	1.84	2.1	2.4	2.7	3.0	3.3

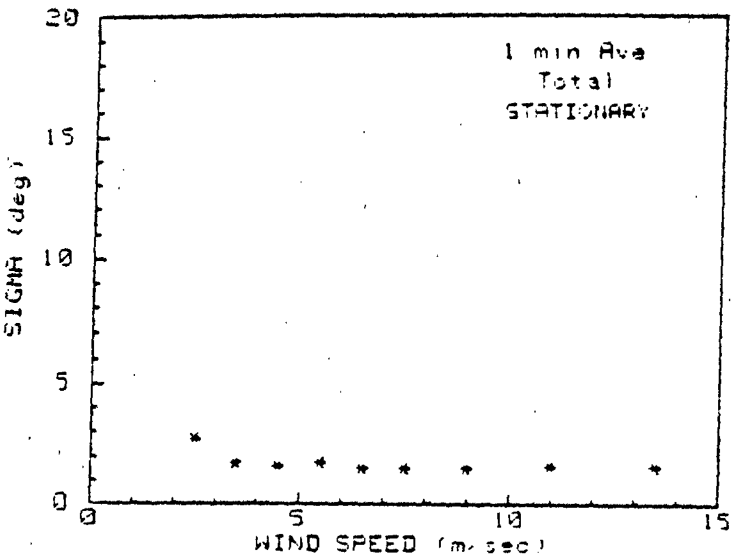
Table 4. Shear production contributions to the wind direction standard deviation as functions of wind speed and averaging time.

The estimates of the mesoscale production contribution are presented in Table 5. There are three columns of numbers for each averaging time. They are calculated using the three methods described above. Examination of the table shows that subtracting the shear production contribution from the non-stationary, stable results leads to consistently higher values for mesoscale production than do the other two methods. We believe that this is due to the fact that the other two methods do not completely seperate the mechanisms and, hence, we accept the higher values as the most nearly correct.

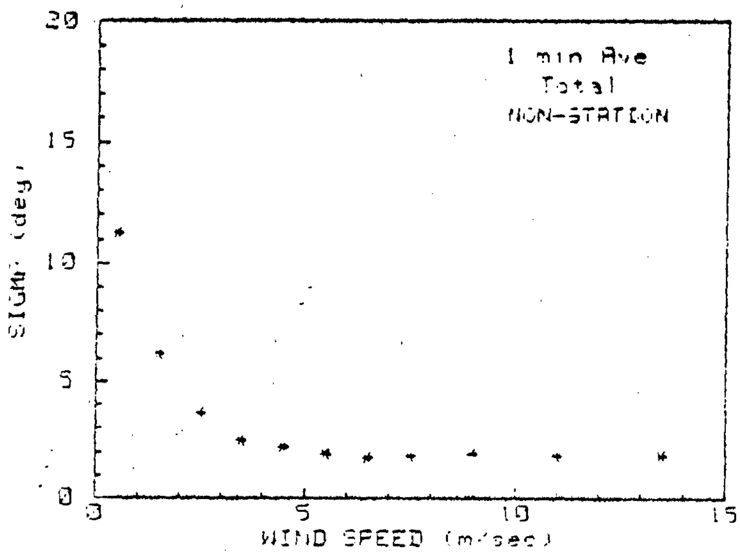
σ_θ (mesoscale) (deg)
for averaging times of

U (m/sec)	T_{ave} = 1 min.			3 min.			10 min.			30 min.			60 min.		
0.5			11.3			17.0			24.1			38.7			52.2
1.5			4.9			8.5			12.9			20.6			25.2
2.5	0.9	0.4	2.4	2.2	1.4	4.6	4.5	2.8	7.8	7.5	1.9	11.1	15.7		18.9
3.5	0.8	1.1	1.1	2.1	3.1	3.3	3.4	4.4	5.0	6.9	7.1	8.4	8.6	7.9	10.8
4.5	0.5	0.4	0.8	1.1	0.7	1.8	1.4	1.1	2.9	2.6	2.0	5.1	4.6	4.2	7.7
5.5	0.1	0.3	0.3	0.4	0.9	1.3	1.0	1.3	2.0	2.3	2.5	3.6	3.5	3.3	5.2
6.5	0.2	0.1	0.1	0.4	0.2	0.5	1.3	0.8	1.4	1.2	1.6	2.6	2.8	2.5	3.8
7.5	0.3	0.3	0.2	0.3	0.3	0.5	0.5	0.5	0.8	1.3	1.1	1.8	1.6	1.0	2.1
9.0	0.3	0.3	0.2	0.1	0.3	0.2	0.1	0.4	0.5	0.4	1.6	1.7			
11.0	0.2	0.3	0.4	0.5	0.9	0.9	0.3	1.0	1.0	0.3	1.0	0.9			
13.5	0.3			0.4			0.5			0.3			0.9		

Table 5: Mesoscale forcing contributions to the wind direction standard deviations. The three columns are calculated from 1) differences in stationary and non-stationary results, 2) differences in stationary and non-stationary results for stable conditions, 3) subtracting shear production from the stable, non-stationary results.

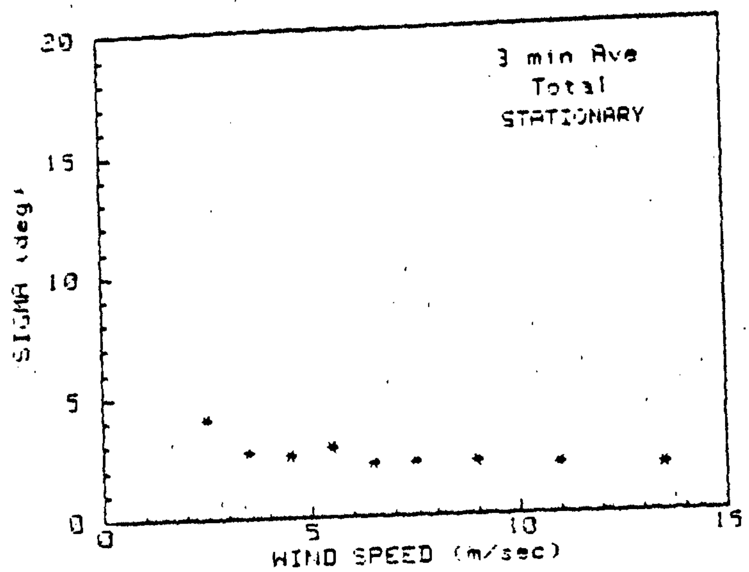


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	5	2.7	1.3
3.5	17	1.7	[illegible]
4.5	26	1.6	.3
5.5	37	1.7	.5
6.5	42	1.5	.4
7.5	35	1.5	.4
9.0	31	1.5	.4
11.0	15	1.6	.3
13.5	13	1.5	[illegible]

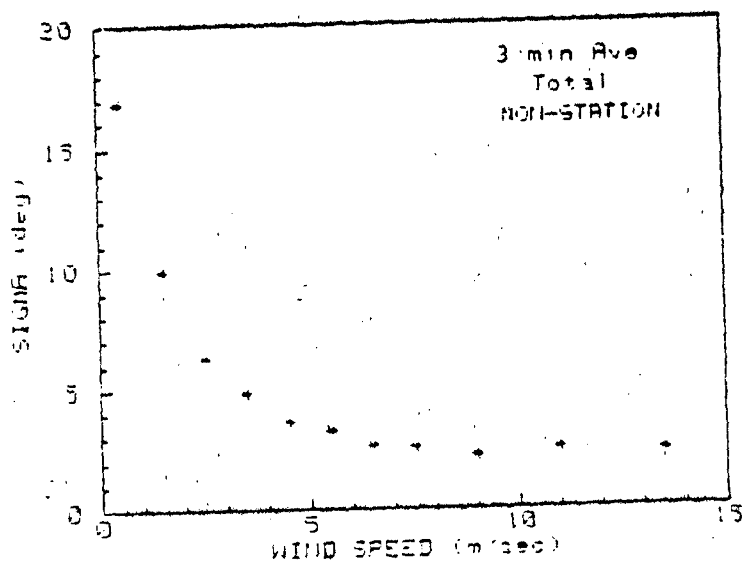


U	#	SIGMA	Std Dev
.5	14	11.2	5.3
1.5	94	6.2	4.2
2.5	134	3.6	3.2
3.5	114	2.5	1.7
4.5	100	2.1	[illegible]
5.5	51	1.8	[illegible]
6.5	26	1.7	[illegible]
7.5	14	1.8	[illegible]
9.0	3	1.8	[illegible]
11.0	2	1.8	[illegible]
13.5	1	1.8	0.0

Figure 19. Means over wind speed ranges of the wind direction standard deviations (sigma); Comparison of stationary and non-stationary conditions.

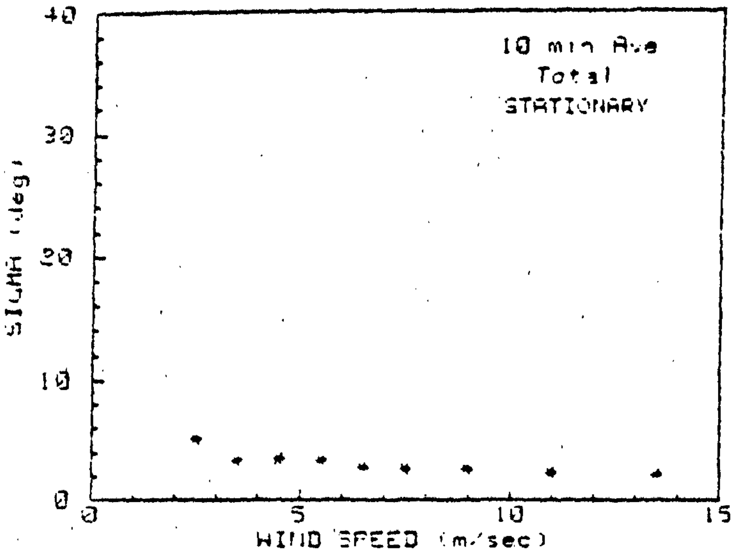


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	5	4.0	1.9
3.5	17	2.7	1.7
4.5	26	2.5	1.[illegible]
5.5	37	2.3	[illegible]
6.5	42	2.2	.6
7.5	35	2.2	.[illegible]
9.0	31	2.1	.[illegible]
11.0	15	2.2	.[illegible]
13.5	13	1.9	.1

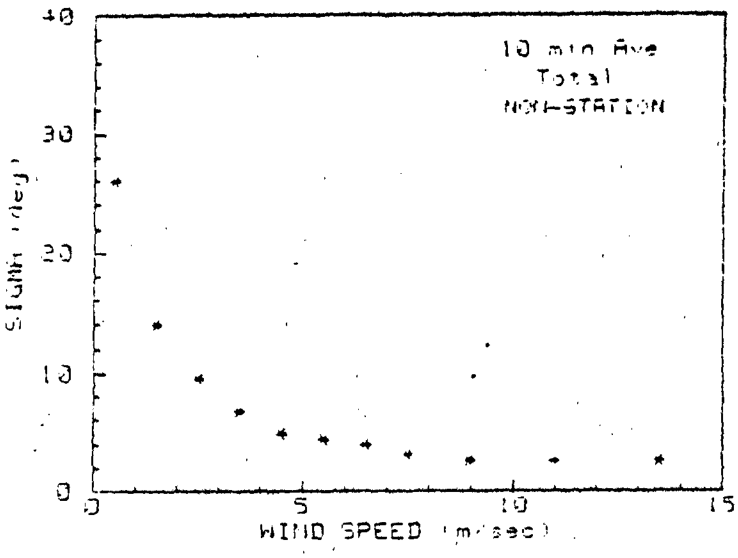


U	#	SIGMA	Std Dev
.5	14	16.9	[illegible]
1.5	94	9.9	5.3
2.5	134	6.[illegible]	[illegible]
3.5	115	4.9	4.[illegible]
4.5	100	3.6	1.[illegible]
5.5	51	3.[illegible]	1.[illegible]
6.5	25	[illegible].6	[illegible]
7.5	14	[illegible].5	[illegible]
9.0	3	[illegible]	.[illegible]
11.0	[illegible]	[illegible].5	.[illegible]
13.5	1	[illegible]	[illegible]

(Figure 19. - continued)

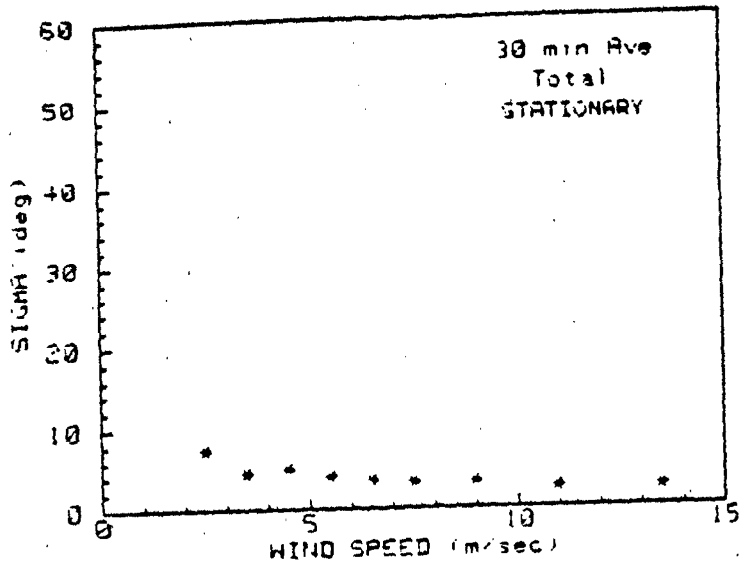


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	5	5.0	2.1
3.5	17	3.3	1.7
4.5	26	3.4	1.9
5.5	37	3.3	1.5
6.5	42	2.6	.3
7.5	35	2.5	.8
9.0	31	2.5	.3
11.0	15	2.2	.7
13.5	13	2.0	.2

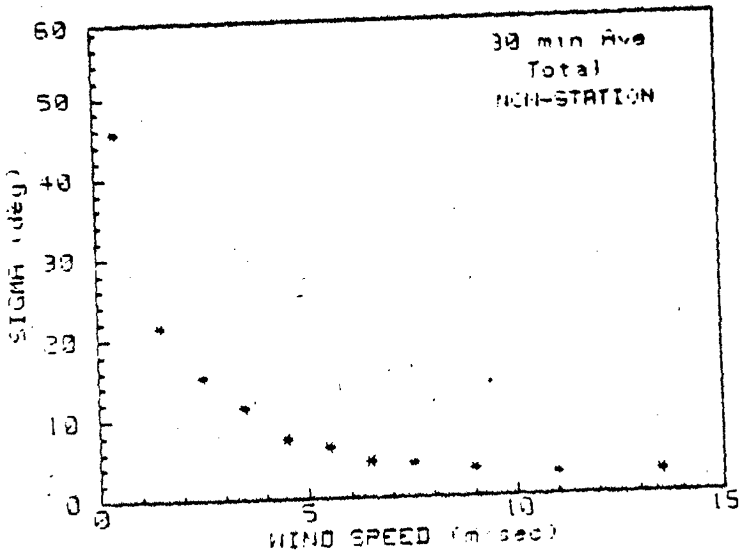


U	#	SIGMA	Std Dev
.5	14	25.9	10.3
1.5	34	14.0	10.1
2.5	134	9.5	7.1
3.5	113	6.7	4.7
4.5	99	4.9	2.5
5.5	51	4.3	2.8
6.5	29	3.9	2.8
7.5	14	3.0	1.3
9.0	3	2.5	.6
11.0	2	2.5	.3
13.5	1	2.5	0.0

(Figure 19. - continued)

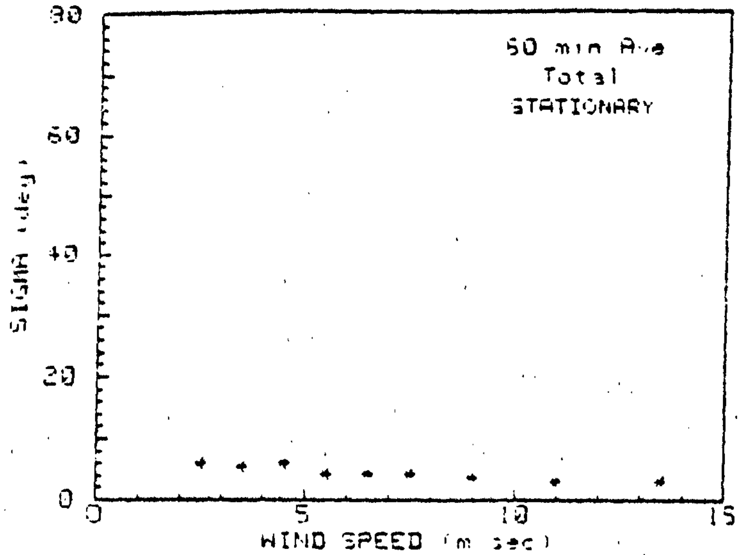


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	5	7.5	3.6
3.5	16	4.4	2.0
4.5	23	4.8	2.9
5.5	36	4.0	1.5
6.5	41	3.4	1.2
7.5	32	3.2	1.1
9.0	31	3.0	1.4
11.0	14	2.4	.8
13.5	12	2.3	.5

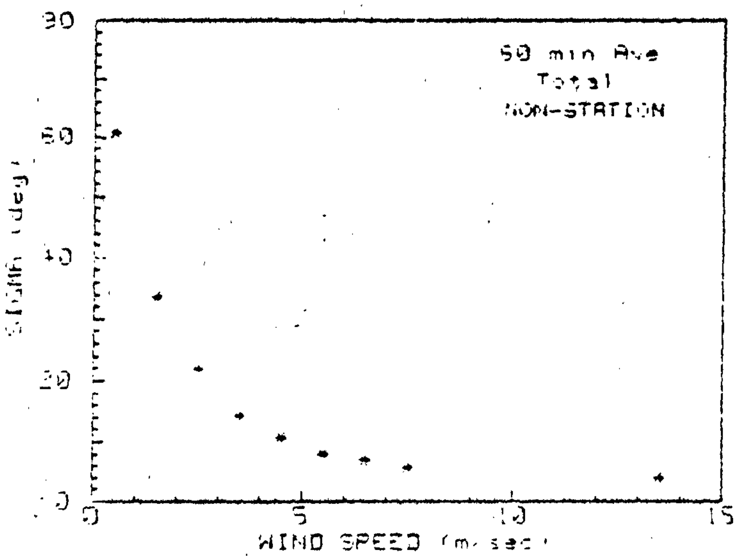


U	#	SIGMA	Std Dev
.5	13	45.5	21.2
1.5	88	21.1	15.6
2.5	115	15.0	12.1
3.5	99	11.3	8.3
4.5	81	7.4	2.3
5.5	45	5.3	3.3
6.5	15	4.5	1.8
7.5	10	4.2	[illegible]
9.0	2	3.4	1.0
11.0	2	2.7	.0
13.5	1	2.6	0.0

(Figure 19. - continued)

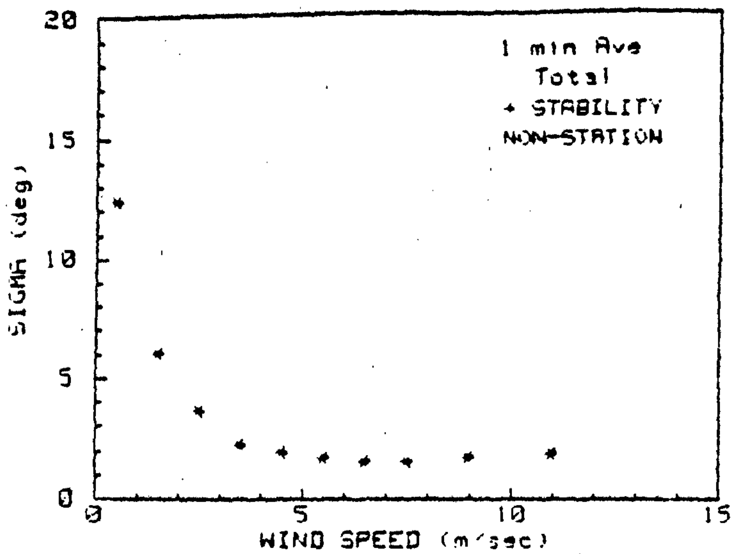


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	2	6.0	2.4
3.5	9	5.4	1.1
4.5	12	5.3	4.2
5.5	16	4.1	1.1
6.5	17	4.2	1.7
7.5	15	4.0	1.3
9.0	15	3.5	1.4
11.0	6	2.3	1.4
13.5	5	2.8	1.0

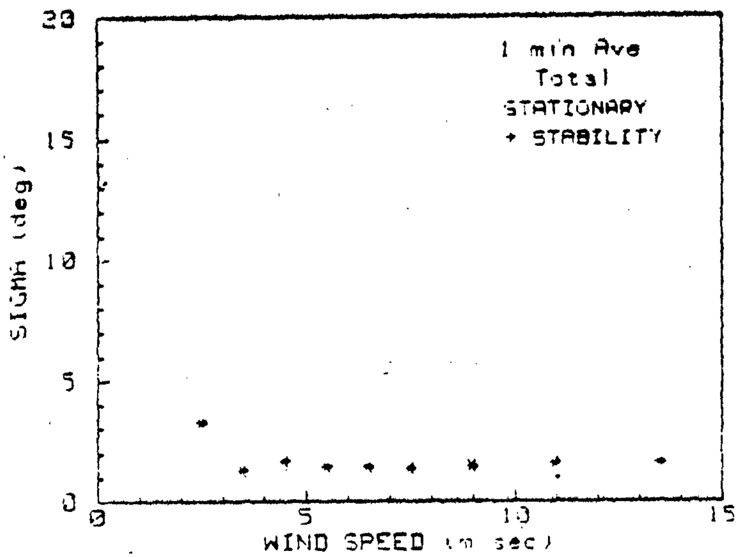


U	#	SIGMA	Std Dev
.5	4	60.6	15.5
1.5	43	33.5	[illegible]
2.5	54	21.7	15.9
3.5	51	14.0	[illegible]
4.5	37	10.5	4.0
5.5	11	7.6	[illegible]
6.5	7	7.0	[illegible]
7.5	5	5.6	[illegible]
9.0	0	0.0	0.0
11.0	0	0.0	0.0
13.5	1	3.7	0.0

(Figure 19. - continued)

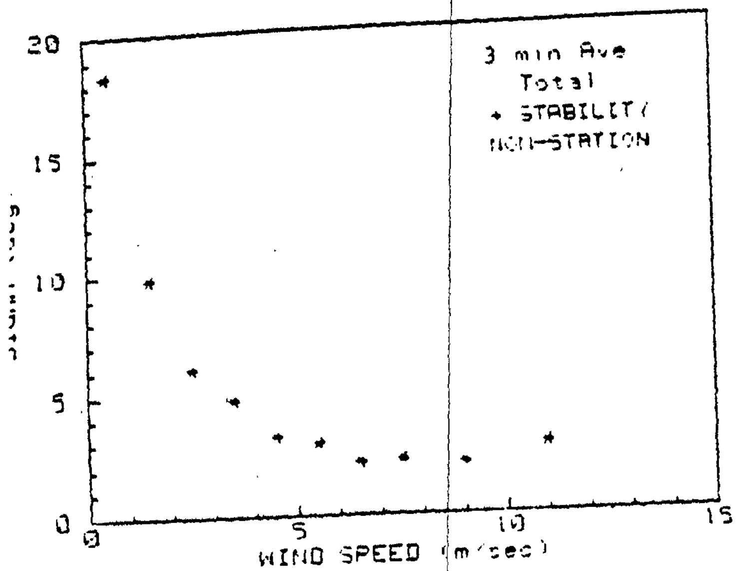


U	#	SIGMA	Std Dev
.5	7	12.4	7.7
1.5	41	6.0	4.4
2.5	62	3.6	1.8
3.5	57	2.3	1.1
4.5	54	2.0	.7
5.5	31	1.7	.6
6.5	19	1.5	.4
7.5	10	1.6	.2
9.0	2	1.7	.7
11.0	1	1.9	0.0
13.5	0	0.0	0.0

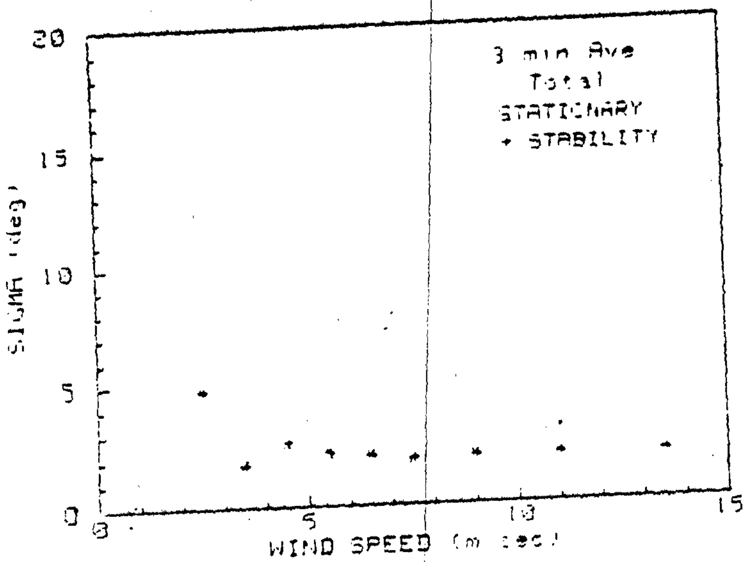


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	2	3.2	1.8
3.5	7	1.2	.4
4.5	16	1.6	.5
5.5	17	1.4	.5
6.5	35	1.4	.3
7.5	21	1.3	.3
9.0	21	1.4	.4
11.0	14	1.5	.3
13.5	13	1.5	.1

Figure 20. Means over wind speed ranges of the wind direction standard deviations (sigma); Comparison of stationary and non-stationary conditions, stable only.

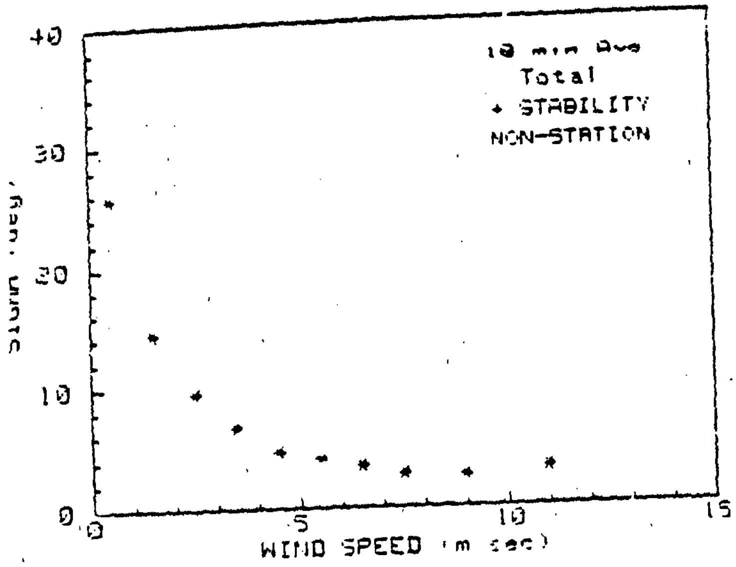


U	#	SIGMA	Std Dev
.5	7	18.3	9.2
1.5	41	9.3	7.1
2.5	62	6.1	3.0
3.5	58	4.8	5.3
4.5	54	3.3	1.5
5.5	31	3.0	1.3
6.5	18	2.2	.6
7.5	10	2.2	.6
9.0	2	2.1	.8
11.0	1	2.8	0.0
13.5	0	0.0	0.0

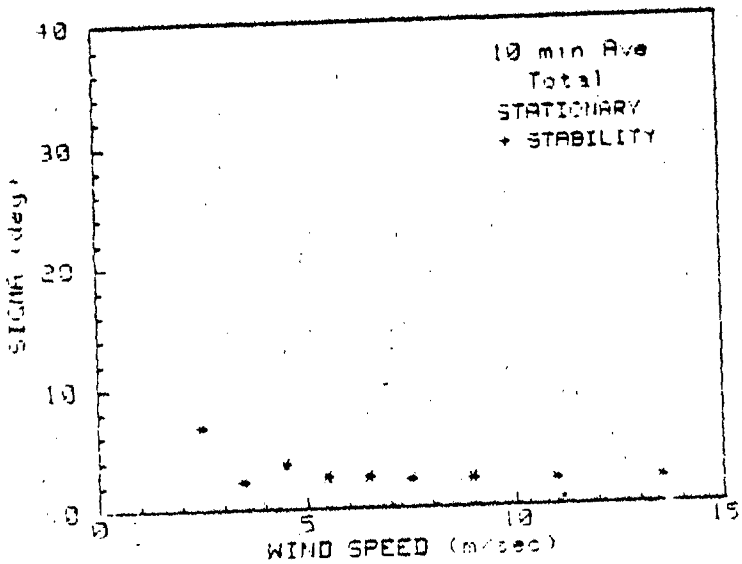


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	2	4.7	1.8
3.5	7	1.7	.4
4.5	16	2.6	1.0
5.5	17	2.1	.3
6.5	35	2.0	.6
7.5	21	1.9	.4
9.0	21	1.3	.5
11.0	14	1.3	.6
13.5	13	1.9	.1

(Figure 20. - continued)

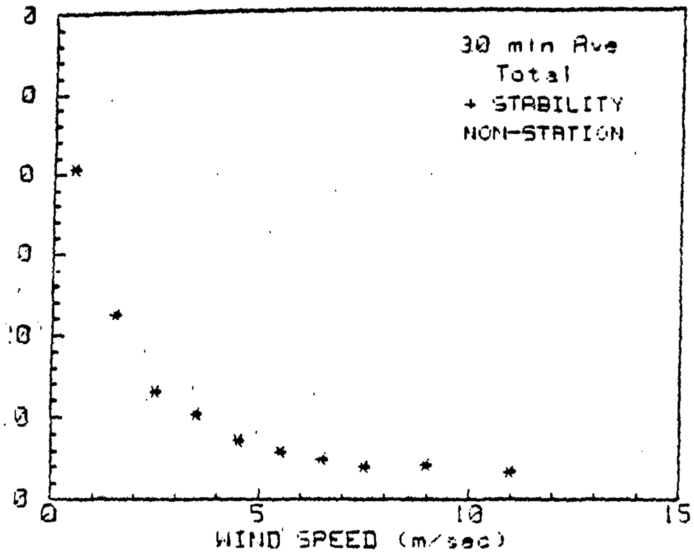


U	#	SIGMA	Std Dev
.5	7	25.6	14.7
1.5	41	14.4	11.2
2.5	52	9.5	7.8
3.5	57	6.7	5.0
4.5	53	4.6	2.5
5.5	31	3.9	2.3
5.5	19	3.3	1.8
7.5	10	2.7	.8
9.0	2	2.6	.9
11.0	1	3.1	0.0
13.5	0	0.0	0.0

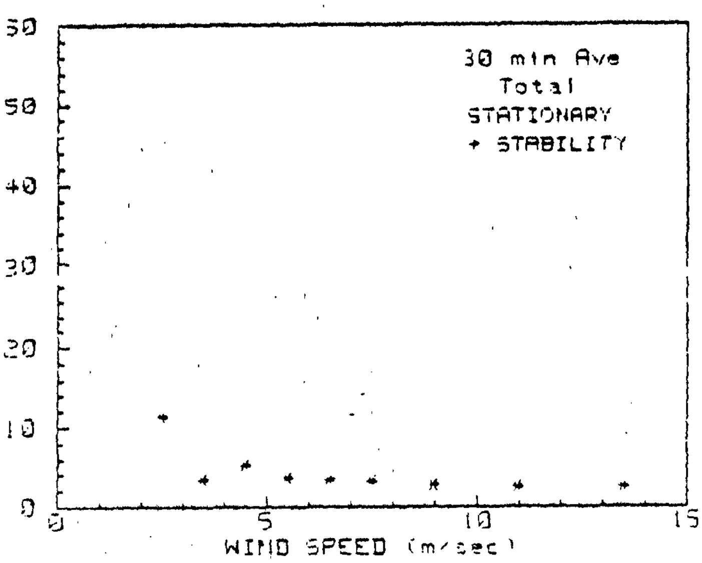


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	2	6.7	1.4
3.5	7	2.3	.6
4.5	16	3.5	1.7
5.5	17	2.6	1.0
6.5	35	2.5	.7
7.5	21	2.2	.5
9.0	21	2.2	.5
11.0	14	2.1	.7
13.5	13	2.0	.2

(Figure 20. - continued)

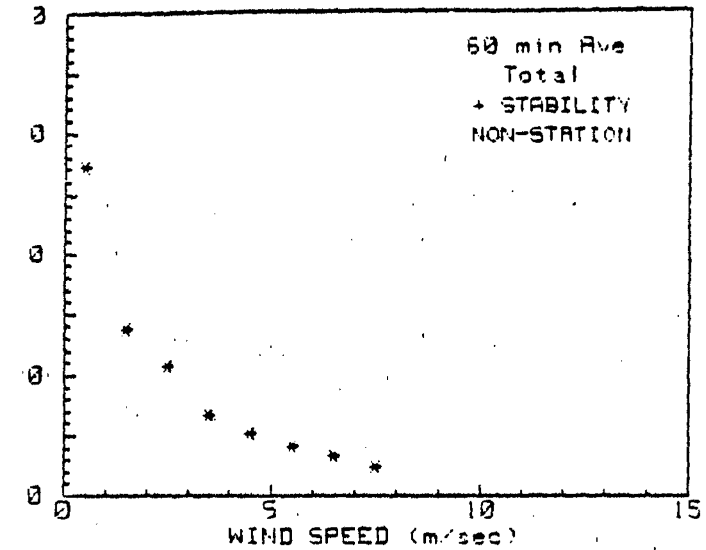


U	#	SIGMA	Std Dev
.5	7	40.5	23.6
1.5	37	22.4	19.4
2.5	46	13.1	7.4
3.5	43	10.4	7.4
4.5	39	7.1	3.0
5.5	26	5.9	3.3
6.5	11	4.9	2.0
7.5	6	4.1	1.6
9.0	1	4.2	0.0
11.0	1	3.4	0.0
13.5	0	0.0	0.0

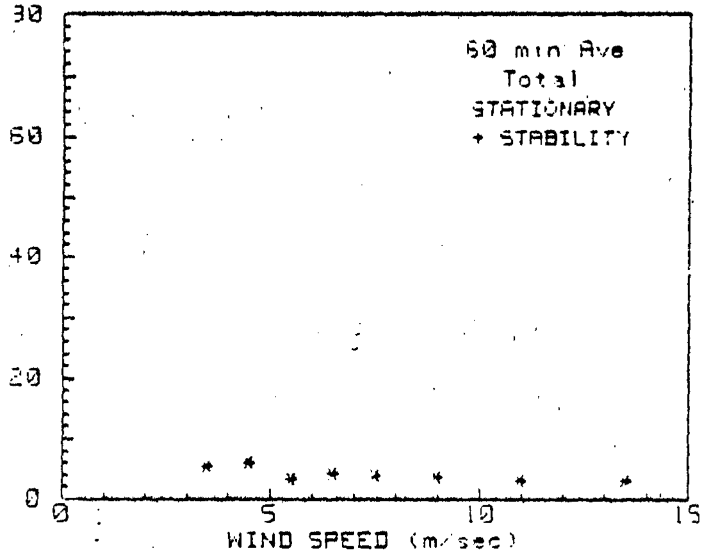


U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	2	11.2	.8
3.5	6	3.3	.9
4.5	14	5.1	3.2
5.5	17	3.4	1.4
6.5	34	3.3	1.2
7.5	18	3.0	1.0
9.0	21	2.6	.7
11.0	13	2.4	.8
13.5	12	2.3	.5

(Figure 20. - continued)



U	#	SIGMA	Std Dev
.5	2	54.3	17.3
1.5	19	27.3	17.6
2.5	16	21.3	11.1
3.5	27	13.2	8.8
4.5	20	10.1	4.1
5.5	7	7.9	3.6
6.5	4	6.5	2.9
7.5	4	4.8	1.6
9.0	0	0.0	0.0
11.0	0	0.0	0.0
13.5	0	0.0	0.0



U	#	SIGMA	Std Dev
.5	0	0.0	0.0
1.5	0	0.0	0.0
2.5	0	0.0	0.0
3.5	3	5.3	.7
4.5	7	5.9	4.6
5.5	7	3.2	.4
6.5	14	4.0	1.7
7.5	8	3.8	1.5
9.0	11	3.6	1.5
11.0	6	2.8	1.4
13.5	5	2.8	1.0

(Figure 20. - continued)

BUOYANCY PRODUCTION,
SORTING σ_θ VS. U WITH w*,
STATIONARY CONDITIONS AND ALL CONDITIONS

The σ versus U data have been sorted into three convective mixing velocity ranges: $0 \leq w* < 0.1$, $0.1 \leq w* < 0.3$, $0.3 \leq w*$, m/sec. This has been done for stationary conditions and for no restrictions other than that w* exists, which means neutral or unstable conditions. The results for stationary conditions are shown in Figure 21, for unstable conditions in Figures 22.

Using only stationary conditions data to determine the buoyancy contribution should yield good results since mesoscale production is minimal. The results in Figure 21 are labeled with a 0, 1, or 3 to indicate the w* range. The printed presentation of the results is the same as for the former figures, except here there are three sets of data, one for each w* range. The results presented in the figure are rather disappointing since the data are not clearly seperated into w* ranges. This is probably due to the fact that the mesoscale contribution is not completely absent. However, the figure does clearly show that the variability is increased by convective activity and that the contribution decreases with increasing wind speed, as expected from the first term in Equation 20.

The estimated contribution of buoyancy to the variability is roughly

$$\sigma_\theta(\text{buoyancy}) \approx 5 \text{ deg at } 4 \text{ m/sec.}$$

This value appears to be independent of the wind speed.

The results for sorting into the w* ranges, with the only restriction being unstable conditions, are shown in Figures 22. This method is not as clean as restricting to only stationary data since the mesoscale forcing is included. However, it is the only way to obtain low wind speed data. If the mean mesoscale forcing was different for the different w* ranges, errors would be introduced into the results.

The results show that buoyancy production is apparent only at wind speeds below about 7 m/sec, with shear production dominating above that speed, as expected.

The results are difficult to quantify with any accuracy, allowing only an estimate of the dependence on w*. The following table gives our best estimate of the w* dependence from these data. Note that the table only includes the difference in σ for $w* < 0.1$ and $w* \geq 0.3$ because we cannot estimate any finer scale without inserting imagination into the process.

		$\sigma_\theta(w* \geq 0.3) - \sigma_\theta(w* < 0.1)$ (deg)				
U(m/sec)	T_{ave} =	1m	3m	10m	30m	60m
<2		3	4	4	?	8
2<U<5		1.5	3	5	6	5
5<U<7		1	2	4	4	5

Table 6. Differences in the wind direction standard deviations for large and small convective mixing velocities.

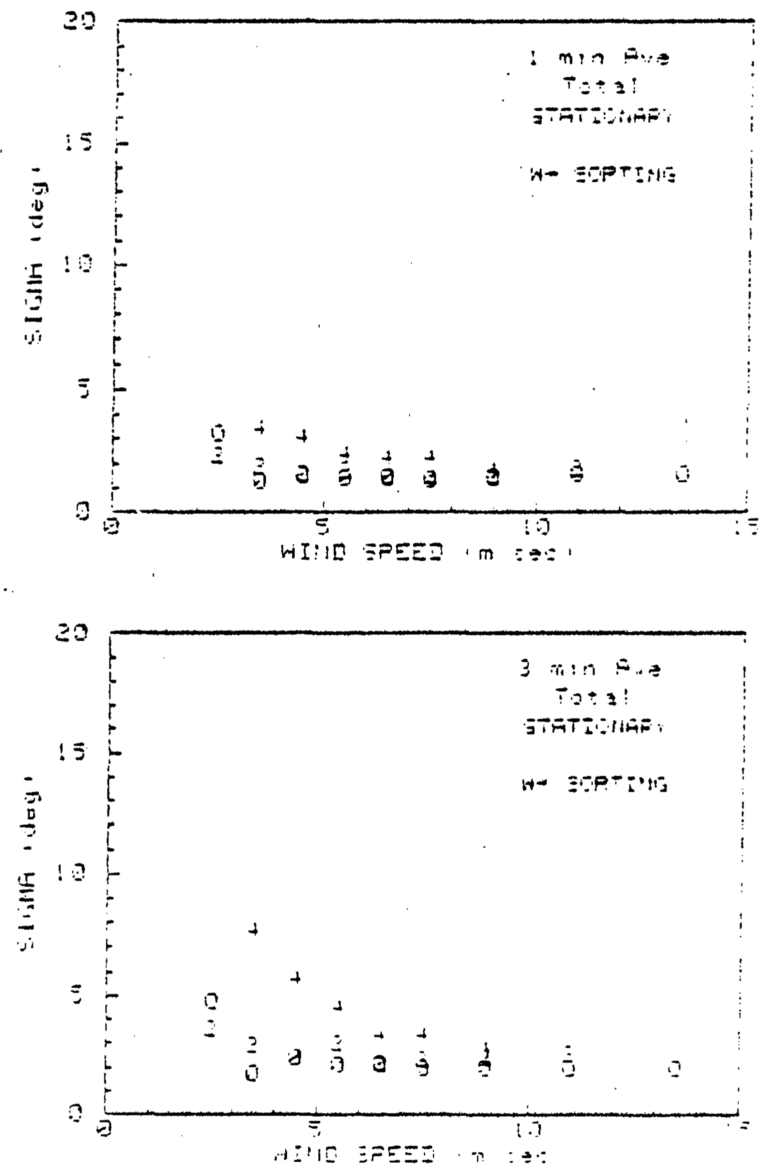
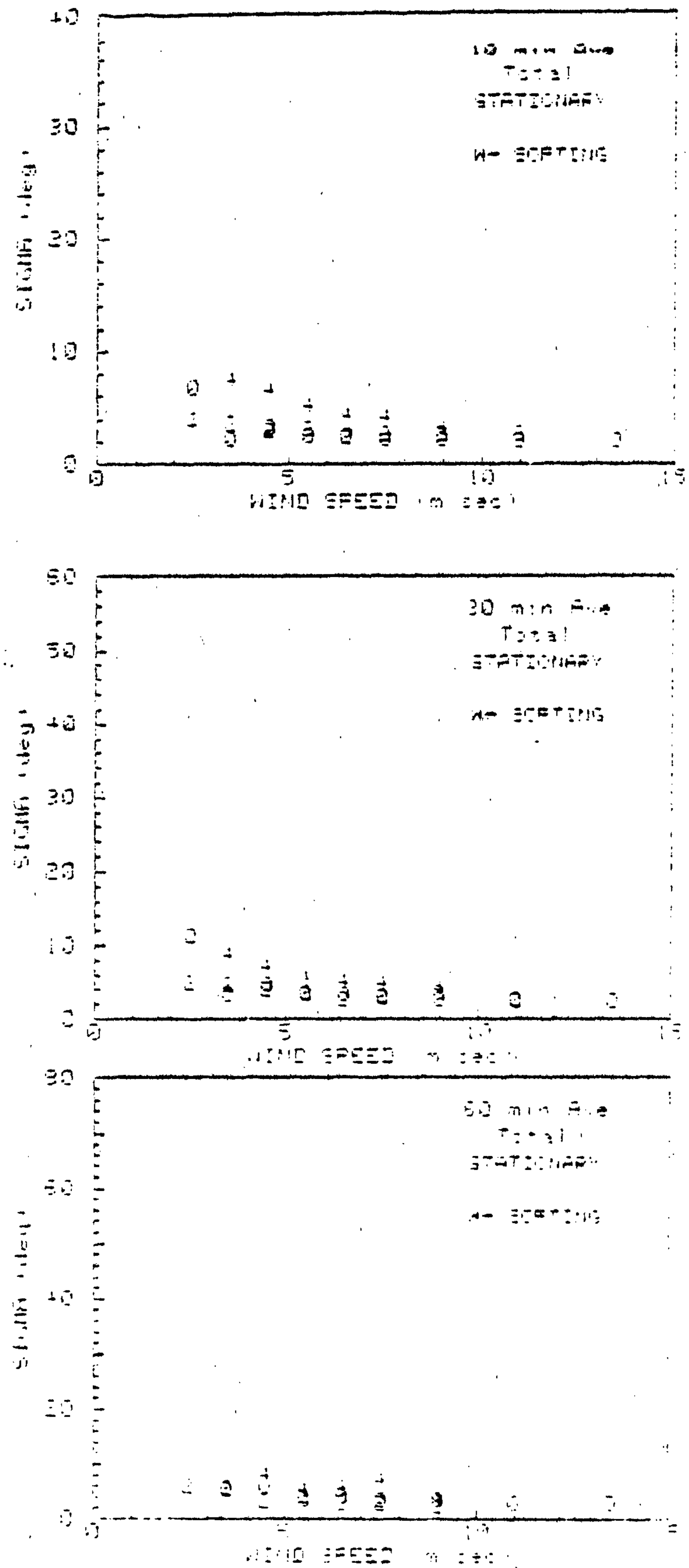
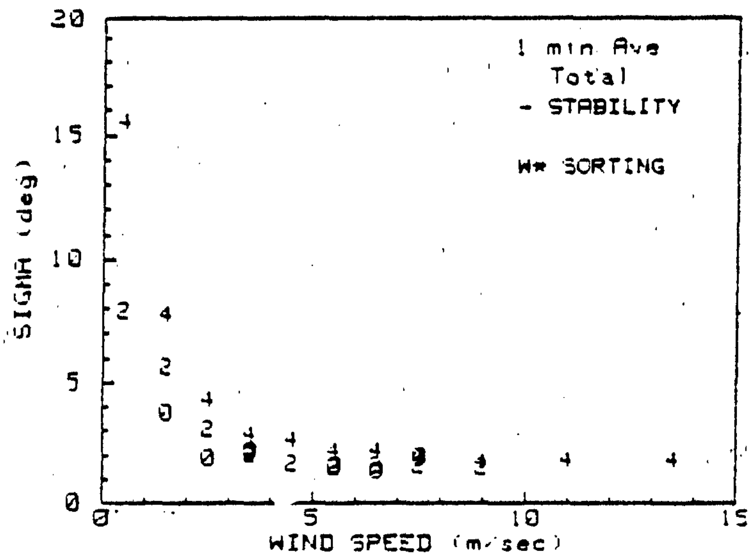


Figure 21. Means over wind speed ranges of the wind direction standard deviations, for stationary conditions, sorted into convective mixing velocity ranges of < 0.1 m/sec (0), 0.1-0.3 m/sec (2), and > 0.3 m/sec (4).

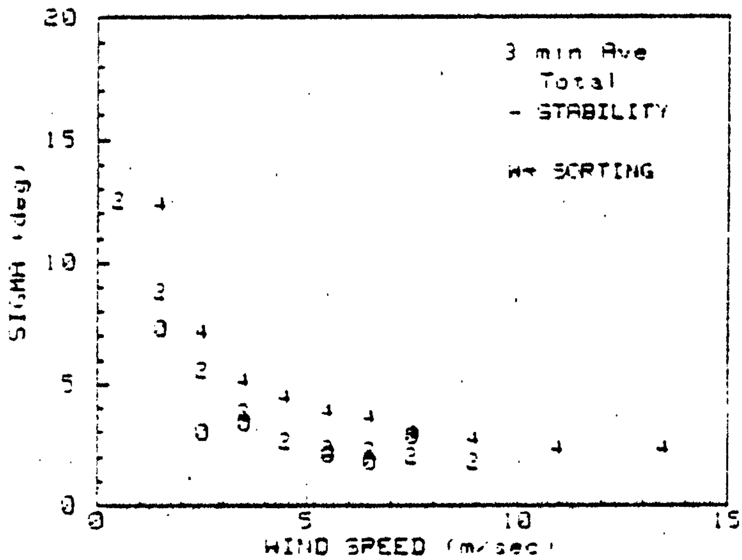


(Figure 21. - contin



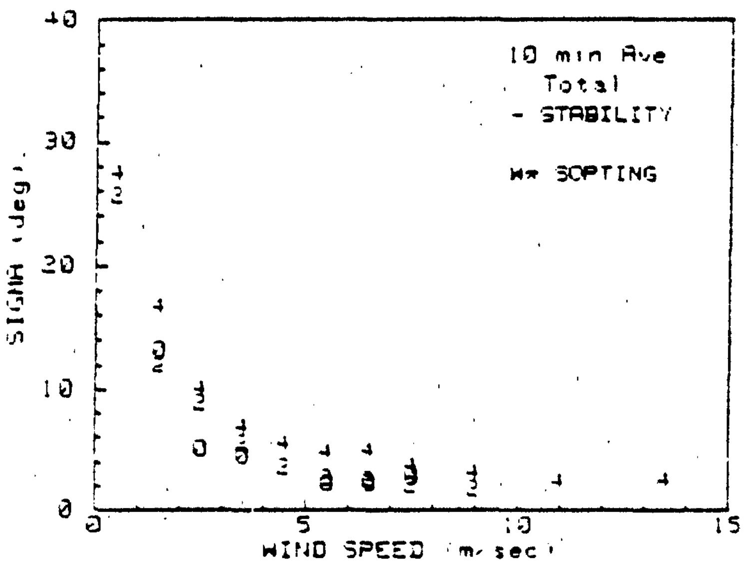
	U		#	SIGMA	Std Dev				
.5	0	0.0	0.0	5	7.9	6.1	2	15.5	2.7
1.5	2	3.7	.2	32	5.6	4.0	19	7.7	4.5
2.5	2	1.9	.7	38	3.0	2.0	35	4.3	2.2
3.5	3	2.2	.8	23	2.0	.8	41	2.9	1.5
4.5	0	0.0	0.0	23	1.6	.4	33	2.6	.7
5.5	1	1.5	0.0	9	1.5	.3	31	2.2	.7
6.5	1	1.3	0.0	4	1.6	.2	10	2.2	.7
7.5	1	2.0	0.0	5	1.5	.2	13	1.9	.5
9.0	0	0.0	0.0	1	1.5	0.0	10	1.7	.2
11.0	0	0.0	0.0	0	0.0	0.0	2	1.8	.1
13.5	0	0.0	0.0	0	0.0	0.0	1	1.8	0.0

Figure 22. Means over wind speed ranges of the wind direction standard deviations, for unstable conditions, sorted into convective mixing velocity ranges of <0.1 m/sec (0), 0.1-0.3 m/sec (2), and > 0.3 m/sec (4).



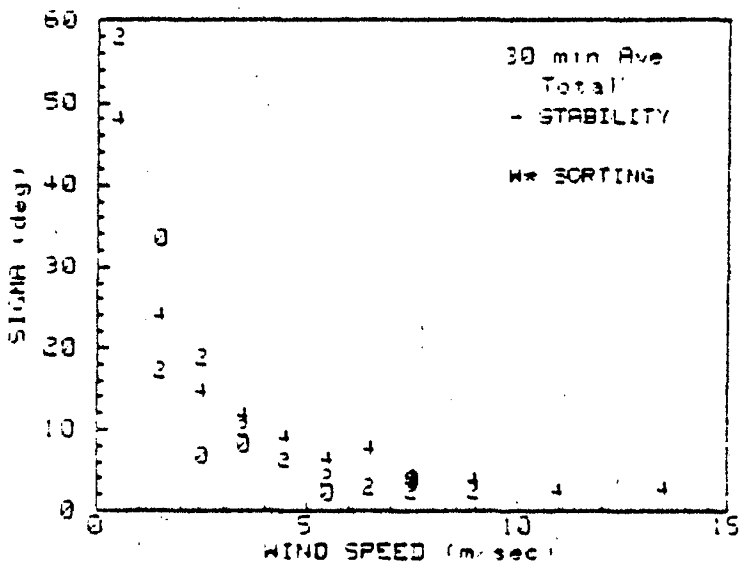
	U		%		SIGMA	Std Dev			
.5	0	0.0	0.0	5	12.5	7.0	2	22.3	8.2
1.5	2	7.3	1.6	32	8.8	6.2	19	12.4	7.5
2.5	2	3.0	.6	38	5.6	3.6	35	7.1	4.0
3.5	3	3.4	.1	23	3.8	2.3	41	5.1	3.3
4.5	0	0.0	0.0	23	2.6	1.2	33	4.4	1.3
5.5	[illegible]	2.0	0.0	9	2.3	.7	31	3.9	1.5
6.5	[illegible]	1.8	0.0	4	2.2	.1	10	3.6	1.5
7.5	1	2.8	0.0	5	2.0	1.1	13	3.0	.7
9.0	0	0.0	0.0	1	1.8	0.0	10	2.7	.6
11.0	0	0.0	0.0	0	0.0	0.0	2	2.3	.2
13.5	0	0.0	0.0	0	0.0	0.0	1	2.3	0.0

(Figure 22. - continue)



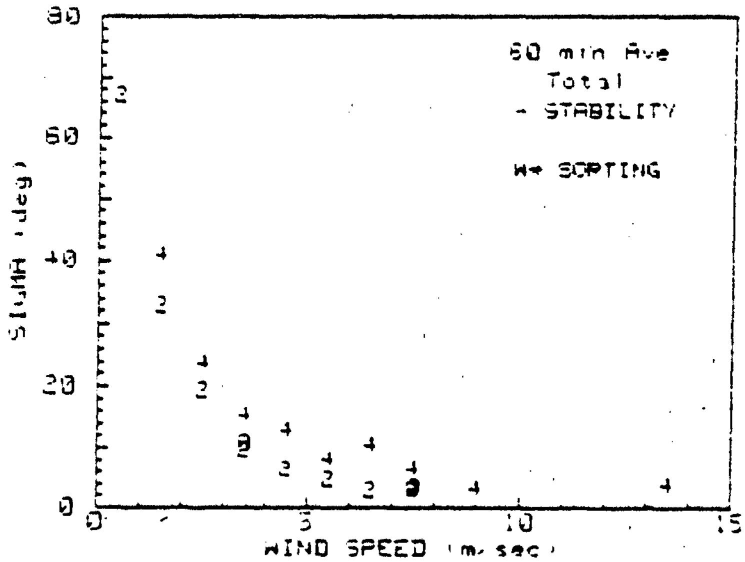
	U		#	SIGMA	Std Dev				
.5	0	0.0	0.0	5	25.6	6.9	2	27.5	7.1
1.5	2	13.2	6.0	32	12.0	8.5	19	16.7	10.2
2.5	2	5.1	.9	38	8.8	5.5	35	10.0	6.6
3.5	3	4.5	1.2	23	5.5	3.6	40	6.9	4.6
4.5	0	0.0	0.0	23	3.6	2.3	33	5.5	2.4
5.5	1	2.1	0.0	9	2.7	.6	31	4.3	2.4
6.5	1	2.1	0.0	4	2.5	.4	10	5.0	3.0
7.5	1	2.9	0.0	5	2.0	.1	13	3.7	[illegible]
9.0	0	0.0	0.0	1	1.8	0.0	10	3.1	1.0
11.0	0	0.0	0.0	0	0.0	0.0	2	2.3	.5
13.5	0	0.0	0.0	0	0.0	0.0	1	2.5	0.0

(Figure 22. - continue)



	U		*		SIGMA	Std Dev			
.5	0	0.0	0.0	5	57.9	19.1	2	48.0	24.4
1.5	2	33.4	32.9	30	17.1	11.3	19	23.3	16.1
2.5	2	5.7	.4	37	18.6	17.4	34	14.6	12.3
3.5	3	8.2	6.0	23	10.0	8.9	40	11.6	11.5
4.5	0	0.0	0.0	21	5.1	3.5	31	8.9	4.8
5.5	1	2.1	0.0	8	3.3	.8	30	6.2	4.2
6.5	0	0.0	0.0	4	3.0	.6	10	[illegible]	[illegible]
7.5	1	3.7	0.0	5	2.2	.1	13	4.2	[illegible]
9.0	0	0.0	0.0	1	2.5	0.0	10	3.9	[illegible]
11.0	0	0.0	0.0	0	0.0	0.0	2	2.4	.5
13.5	0	0.0	0.0	0	0.0	0.0	1	2.6	0.0

(Figure 22. - continue)



	U		$	SIGMA		Std Dev			
.5	0	0.0	0.0	2	67.0	19.3	0	0.0	0.0
1.5	1	32.7	0.0	13	33.0	25.9	10	40.9	20.3
2.5	0	0.0	0.0	23	19.1	15.6	17	23.6	19.8
3.5	1	10.7	0.0	9	9.5	9.0	19	15.3	13.3
4.5	0	0.0	0.0	10	6.4	4.0	12	12.0	4.3
5.5	0	0.0	0.0	3	4.7	.0	11	9.2	3.4
6.5	0	0.0	0.0	1	3.0	0.0	6	10.4	9.1
7.5	1	3.4	0.0	4	3.0	.5	4	5.6	2.7
9.0	0	0.0	0.0	0	0.0	0.0	4	3.3	.9
11.0	0	0.0	0.0	0	0.0	0.0	0	0.0	0.0
13.5	0	0.0	0.0	0	0.0	0.0	1	3.7	0.0

(Figure 22. - continue)

BUOYANCY PRODUCTION,

σ_θ VS. U FOR STABLE AND UNSTABLE CONDITIONS

Dividing the wind speed dependence data into unstable and stable catagories allows another estimate of the buoyancy production. Graphs and printouts of the data are presented in Figures 23. Since the data are not segmented into w* catagories, only the increase in turbulence due to buoyancy averaged over all w* values encountered can be determined. The following table lists the differences in σ for unstable and stable conditions.

		σ_θ(unstable) - σ_θ(stable) (deg)				
U(m/sec)	T_{ave}=	1m	3m	10m	30m	60m
0.5		2.3	3.0	0.5	11.0	12.7
1.5		0.3	0.2	-0.7	-2.1	11.0
2.5		0	0.1	-0.1	2.7	-0.3
3.5		0.3	0.1	0.1	1.5	0.9
4.5		0.3	0.5	0.3	0.5	0.9
5.5		0.4	0.7	0.8	0.7	0
6.5		0.5	1.0	0.8	0	1.6
7.5		0.4	0.7	0.9	0.5	0.6
9.0		0.3	0.7	0.8	1.0	-0.3

Table 7. Differences in the wind direction standard deviations for unstable and stable conditions.

These results are rather peculiar. The 10 min average results at low wind speeds are anomously low (little buoyancy contribution). Also, one would expect a smooth decrease with wind speed, proportional to 1/U as in Equation 20. The decrease seems much too rapid, and there appears to be a minimum around 2 m/sec. We have no explanation for these affects.

Another disturbing aspect of the data is that the lowest σ do not occur for stable conditions. Comparison of these figures with Figures 22 shows that the lowest σ occur for unstable, low wind speed conditions. For example, the values found in Figure 20 and 21, for 1 min averages, 1.5 m/sec, compared to Figure 23 results are:

w_* =	0-0.1	0.1-0.3	0.3+	unstable	stable
σ_θ =	4.2	5.7	7.7	6.3	6.0

and for 30 min ave 3.5 m/sec

w_* =	0-0.1	0.1-0.3	0.3+	unstable	stable
σ_θ =	8.2	10.0	11.8	11.0	9.5

The only conclusion that can be reached here is that comparing the unstable data to the stable can be very difficult because the strength of the mesoscale forcing may be different for the various data periods. This analysis relies on being able to take

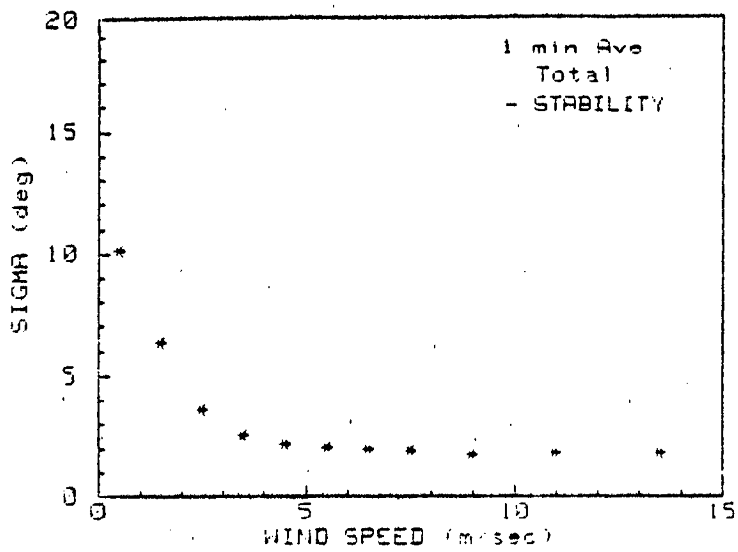
the differences between unstable and stable conditions to find the buoyancy contribution, which can only be done accurately if other production terms remain constant. Since we use wind speed as a parameter, shear production automatically is subtracted out.

Because of the above mentioned difficulties it is advisable to have as large a w* contribution as possible for this method. Thus, in Table 8 we present results for the same analysis, but restricting to w* values greater than or equal to 0.3 m/sec from Figures 22. There is some reduction in the number of data points used, and resultant reduction in statistical validity, but this is more than compensated for by not mixing together a wide range of w* values.

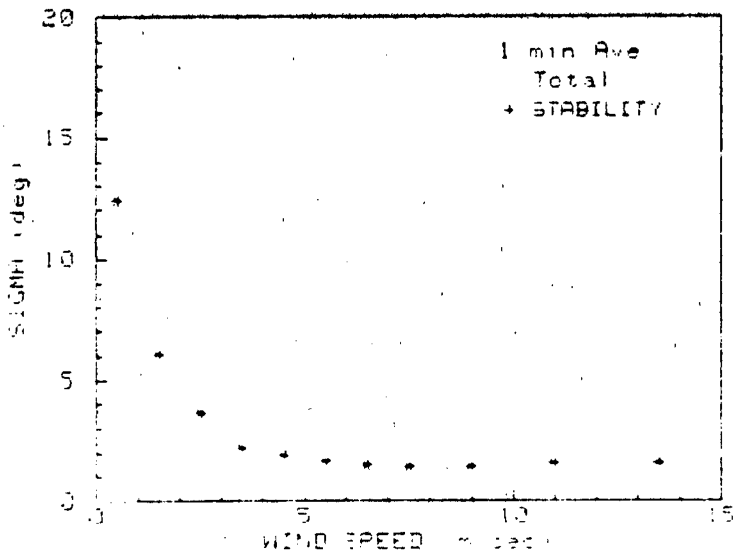
σ_θ(unstable) - σ_θ(stable) (deg)

U(m/sec)	T_{ave} =	1m	3m	10m	30m	60m
0.5		3.1	4.0	1.9	8.0	-
1.5		1.7	2.6	2.3	1.4	13.3
2.5		1.1	1.0	0.6	1.5	2.3
3.5		0.7	0.6	0.7	2.3	2.9
4.5		0.7	1.2	1.1	2.3	3.8
5.5		0.6	1.1	1.3	1.3	0.2
6.5		0.8	1.5	2.2	0.4	2.3
7.5		0.5	1.0	1.4	1.0	2.5
9.0		0.3	0.8	0.9	1.2	-0.3
11.0		0.2	0.3	0.1	-0.1	-
13.5		0.3	0.4	0.5	0.3	0.9

Table 8. Differences in the wind direction standard deviations for unstable conditions with the convective mixing velocity greater than 0.3 m/sec, and stable conditions.

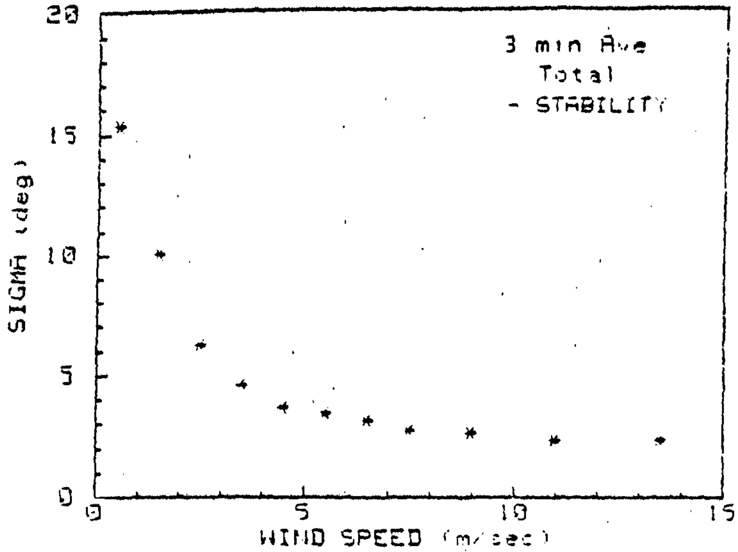


U	#	SIGMA	Std Dev
.5	7	10.1	6.3
1.5	53	6.3	4.2
2.5	75	3.6	2.2
3.5	67	2.5	1.3
4.5	56	2.2	.8
5.5	41	2.0	.7
6.5	15	1.9	.6
7.5	19	1.8	.5
9.0	11	1.7	.3
11.0	2	1.8	.1
13.5	1	1.8	0.0

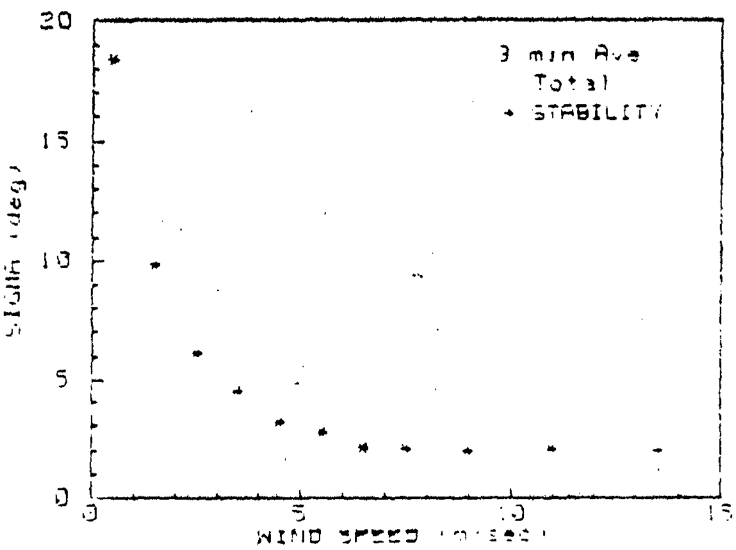


U	#	SIGMA	Std Dev
.5	7	12.4	7.7
1.5	41	6.0	4.4
2.5	64	3.6	1.3
3.5	64	2.2	1.1
4.5	70	1.9	.7
5.5	43	1.6	.6
6.5	54	1.4	.4
7.5	21	1.4	.3
9.0	23	1.4	.5
11.0	15	1.5	.3
13.5	13	1.5	.1

Figure 23. Means over wind speed ranges of the wind direction standard deviations for stable and unstable conditions.

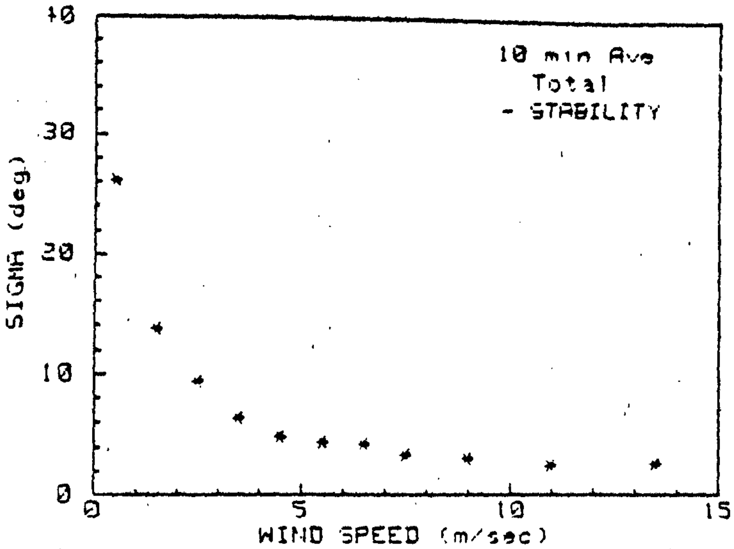


U	#	SIGMA	Std Dev
.5	7	15.3	8.1
1.5	53	10.0	6.8
2.5	75	6.2	3.3
3.5	67	4.6	3.2
4.5	56	3.7	1.9
5.5	41	3.4	1.3
6.5	15	3.1	1.4
7.5	19	2.7	.7
9.0	11	2.6	.6
11.0	2	2.3	.2
13.5	1	2.3	0.0

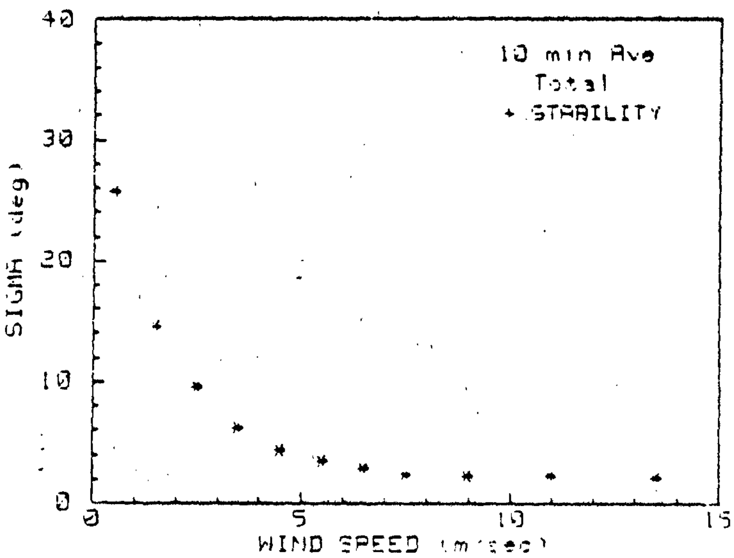


U	#	SIGMA	Std Dev
.5	7	18.3	8.2
1.5	41	9.9	7.1
2.5	64	6.1	3.2
3.5	65	4.5	[illegible]
4.5	70	3.2	1.4
5.5	48	2.7	1.2
6.5	53	2.1	[illegible]
7.5	31	2.0	[illegible]
9.0	22	1.9	[illegible]
11.0	15	2.0	[illegible]
13.5	13	1.9	[illegible]

(Figure 23. - continue)

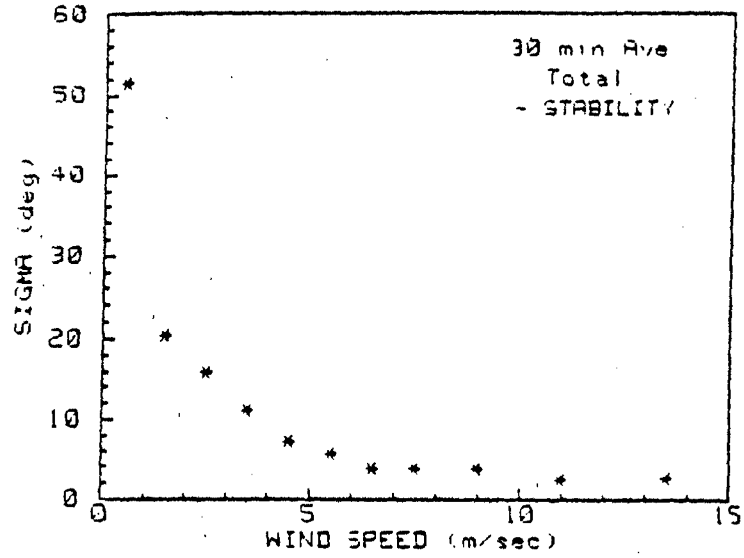


U	#	SIGMA	Std Dev
.5	7	26.1	6.4
1.5	53	13.7	9.2
2.5	75	9.3	6.5
3.5	66	6.3	4.2
4.5	56	4.7	2.5
5.5	41	4.3	2.3
6.5	15	4.1	2.7
7.5	19	3.2	1.2
9.0	11	3.0	1.0
11.0	2	2.3	.5
13.5	1	2.5	0.0

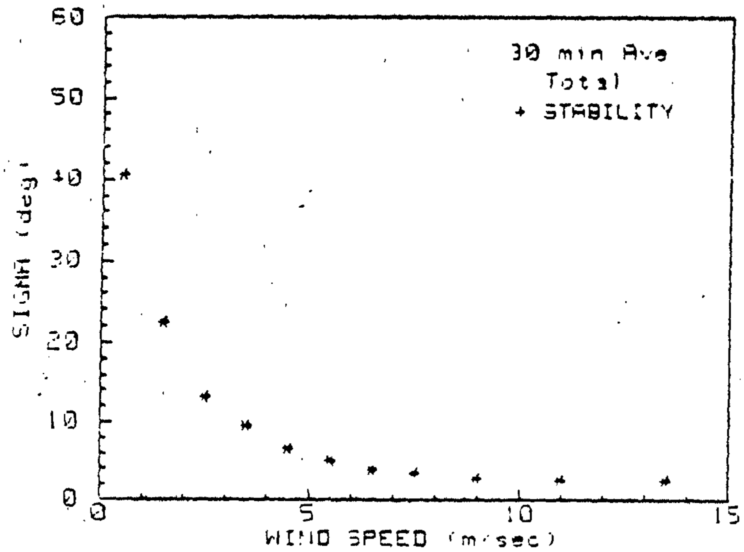


U	#	SIGMA	Std Dev
.5	7	25.6	14.7
1.5	41	14.4	11.2
2.5	64	9.4	[illegible]
3.5	64	6.2	4.0
4.5	69	4.4	2.3
5.5	43	3.5	2.2
6.5	54	2.3	[illegible]
7.5	31	2.3	[illegible]
9.0	23	2.2	.5
11.0	15	2.2	[illegible]
13.5	13	2.0	[illegible]

(Figure 23. - continue)

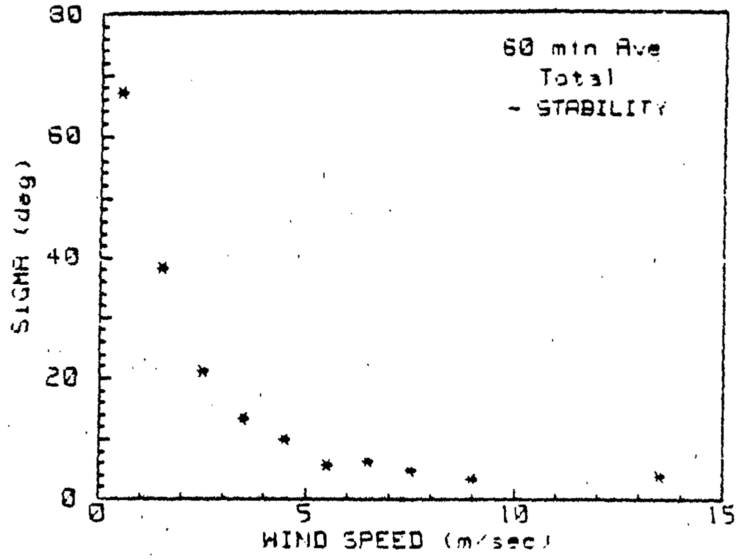


U	#	SIGMA	Std Dev
.5	6	51.5	13.2
1.5	51	20.3	14.4
2.5	72	15.8	14.2
3.5	66	11.0	10.4
4.5	51	7.1	4.5
5.5	39	5.6	3.6
6.5	12	3.7	1.0
7.5	19	3.7	1.4
9.0	11	3.7	2.0
11.0	2	2.4	.5
13.5	1	2.6	0.0

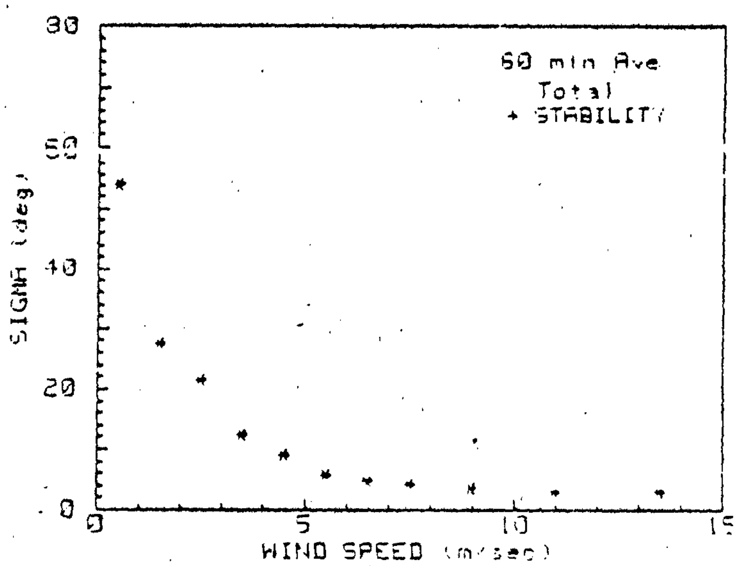


U	#	SIGMA	Std Dev
.5	7	40.5	23.5
1.5	37	22.4	19.4
2.5	48	13.1	7.2
3.5	49	9.5	7.3
4.5	53	6.6	3.1
5.5	43	4.9	2.0
6.5	45	3.7	1.5
7.5	24	3.2	1.2
9.0	22	2.7	.3
11.0	14	2.5	.3
13.5	12	2.3	.5

(Figure 23. - continue)



U	#	SIGMA	Std Dev
.5	2	67.0	13.3
1.5	24	38.3	25.4
2.5	40	21.0	17.4
3.5	29	13.3	12.0
4.5	22	9.9	5.7
5.5	13	5.5	2.2
6.5	6	6.2	3.1
7.5	9	4.7	2.5
9.0	4	3.3	.9
11.0	0	0.0	0.0
13.5	1	3.7	0.0



U	#	SIGMA	Std Dev
.5	2	54.3	17.3
1.5	19	27.3	17.5
2.5	16	21.3	11.1
3.5	30	12.4	3.6
4.5	27	9.0	4.5
5.5	14	5.5	3.5
6.5	19	4.6	2.2
7.5	12	4.1	1.5
9.0	11	3.6	1.5
11.0	6	2.8	1.4
13.5	5	2.8	1.0

(Figure 23. - continue)

BUOYANCY PRODUCTION,

σ_Θ vs. w_* and σ_Θ vs. w_*/U, STATIONARY CONDITIONS

Ideally, the dependence of the variability on buoyancy should be determined directly from the dependence of σ on $w*$. As has been pointed out above, this can only be done for stationary conditions because the effect is obscured by mesoscale forcing for other conditions. Of course, restricting to stationary conditions restricts the range examined to low wind speeds. Also, it is difficult to seperate $w*$ and U dependence for any conditions since $w*$ depends on the surface heat flux, which depends on the wind speed. In spite of all of this the situation is not hopeless, as we have seen, and in what follows we extend the buoyancy analysis one step further.

The dependences of σ on $w*$ and on $w*/U$ are presented in Figures 24 and 25, respectively. The mean wind speeds for the various $w*$ and $w*/U$ ranges are:

$w*$	$\langle U \rangle$	$10(w*/U)$	$\langle U \rangle$
.15	5.9	.25	6.9
.25	4.3	.50	6.9
.35	6.0	.75	6.1
.45	7.4	1.00	4.8
.55	6.1	1.25	3.8
mean	5.9	1.50	3.0

The mean wind speed is fairly constant over the $w*$ ranges and there is no systematic variation. The $w*/U$ results have a factor of 2 monatonic change in mean wind speed over the factor of 6 change in $w*/U$. From these results we conclude that the $w*$ dependence is not contaminated by wind speed dependence and that it can be obtained directly from the plots in Figure 24. Of course, the results may only be valid for the conditions for which the data were obtained, U - 6 m/sec. The $w*/U$ dependence from Figure 25 can also be used to find the dependence on $w*$.

The dotted lines in the figures are theoretical curves derived from Equation 20.

$$\sigma_\Theta^2 = C_w\, k^{2/3} (w*/U)^2 + C_U\, F(L)(7.5 \times 10^{-4} + 6.7 \times 10^{-5}\, U) \quad (20)$$

This equation was used directly to fit the $w*/U$ curves in Figure 25, with U in the second term coming from a fit to the <U> data presented above. The $w*$ curves, Figure 24, were fit with Equation 20, using U = 5.9 m/sec from the mean U which was found; this gives

$$\sigma_\Theta^2 = 0.014\, C_w w*^2 + 0.00114\, C_U F(L) \quad (22)$$

We have assumed F(L)=1 in fitting theory to data and used C_w and C_U as fitting parameters. The results for the parameters are

Tave	w* results C_w	w* results C_U	w*/U results C_w	w*/U results C_U
1m	.35	.45	.25	.45
3m	1.1	0.9	0.7	1.0
10m	1.5	1.2	1.1	1.0
30m	1.7	2.4	1.5	1.4
60m	1.9	3.4	1.4	2.8

Table 9. Fitting parameters for the dependence of the wind direction standard deviation on buoyancy, w* and w*/U.

Obviously, the values of the parameters C_w and C_U found by fitting the σ vs w* and σ vs. w*/U data should be the same. Table 9 shows some difference between them. The discrepency is not surprising considering the use of mean wind speeds, $F(L)=1.0$, and with there being some mesoscale production contamination in the stationary data.

In the next section we will reach the final parameterization by fitting to the non-restricted data, so final discussions about these results will be postponed until that point.

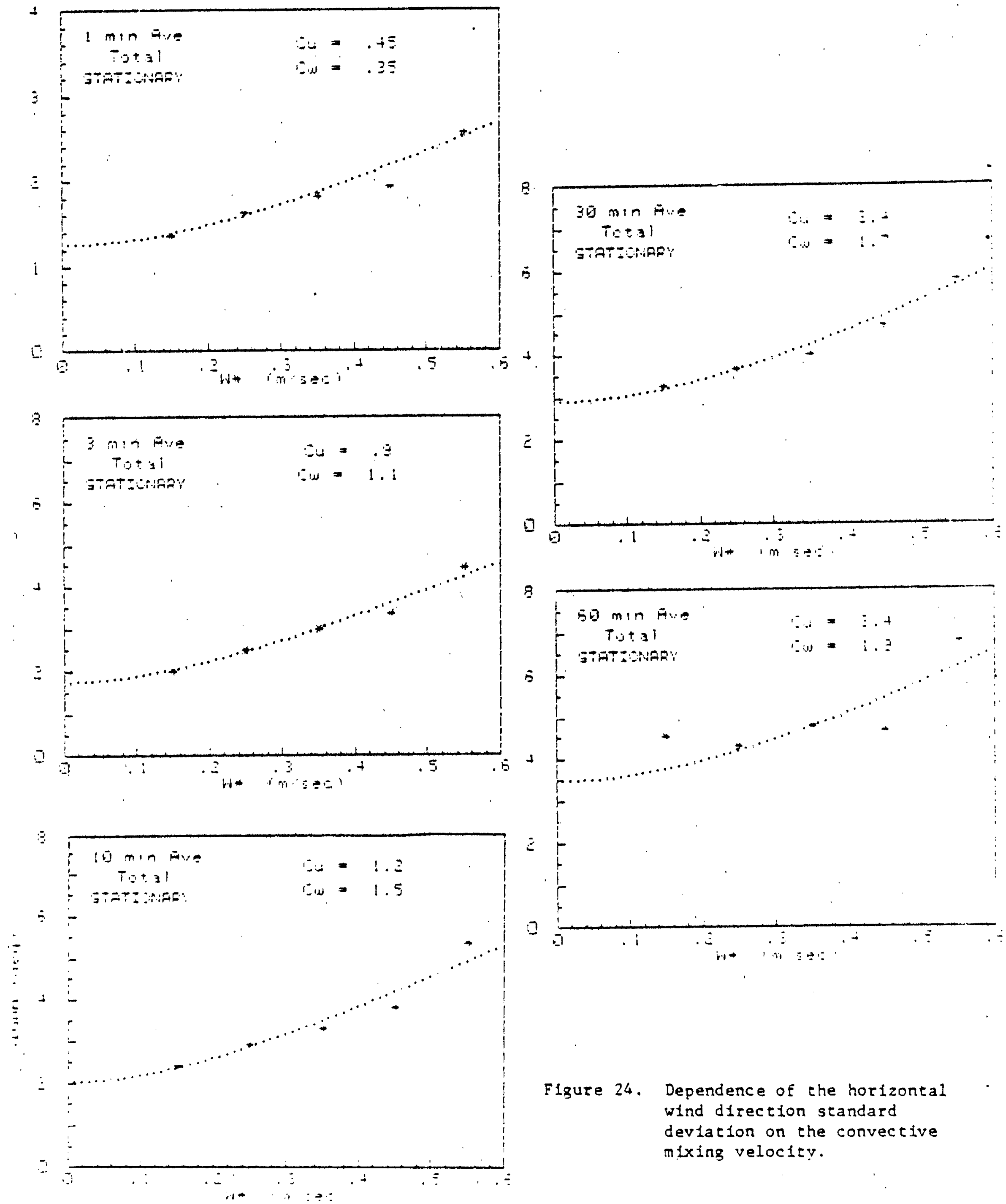


Figure 24. Dependence of the horizontal wind direction standard deviation on the convective mixing velocity.

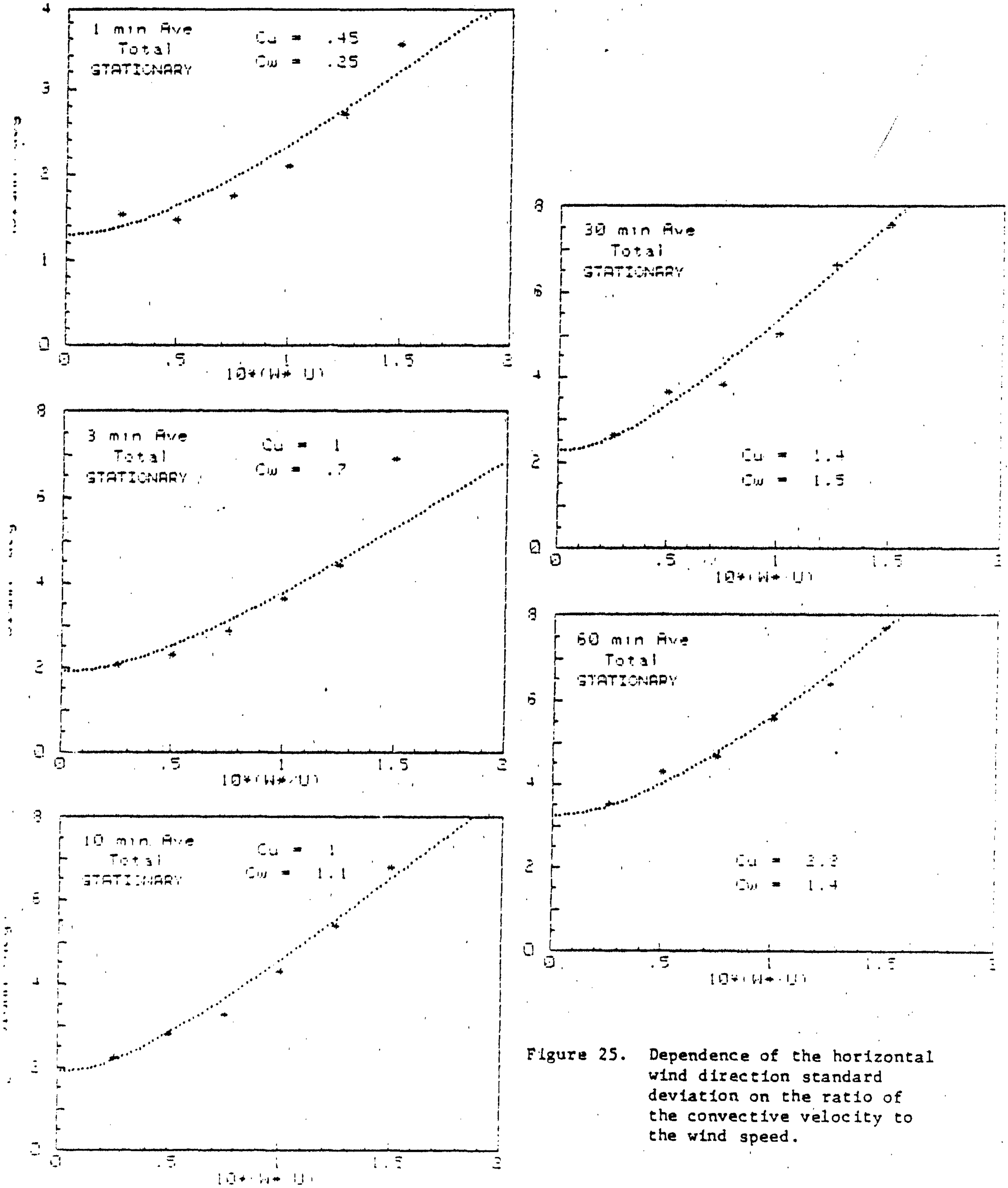


Figure 25. Dependence of the horizontal wind direction standard deviation on the ratio of the convective velocity to the wind speed.

STABILITY DEPENDENCE,

σ_Θ vs. Z/L

There is some question as to whether stability is a good parameter for scaling overwater horizontal wind variability. In what has gone before in this section, we have analysed these data to produce parameterizations for shear, buoyancy, and mesoscale produced turbulence. The calculation of stability involves both the momentum and heat fluxes, thus includes the first two production mechanisms. Thus, examining stability adds no new information, but can be used to combine two effects into one parameter. In what follows we only examine stability as a parameter, judgements as to its usefulness appear in the next section.

This analysis can proceed in two ways: one is to produce a parameterization for Z/L and the other is to find C_w for Equation 21 using Z_i/L as the parameter. We do not take the second approach since we are fitting using w* as a parameter in what follows and Z_i/L and w* are directly related.

Plots of the variability as a function of Z/L (for Z=10m) are shown in Figures 26. The solid lines through the averaged data are the linear regression fits to the original data. We see that the dependence on Z/L for unstable conditions is somewhat steeper than for stable, but not nearly as much greater as one would expect. The results are mainly due to the dependence on wind speed rather than on the surface heat flux (buoyancy). The

parameters for the linear regression fits are presented in the following table.

Ave Time		Intercept	Slope	Correlation	Delta Slope
1m	+Z/L	1.8	0.6	0.36	0.07
	-Z/L	2.0	-1.8	0.67	0.11
3m	+Z/L	3.0	1.1	0.36	0.14
	-Z/L	3.6	-2.6	0.60	0.18
10m	+Z/L	3.8	2.5	0.43	0.27
	-Z/L	4.9	-3.7	0.54	0.30
30m	+Z/L	5.9	3.5	0.39	0.45
	-Z/L	8.9	-5.2	0.37	0.69
60m	+Z/L	7.7	6.2	0.57	0.72
	-Z/L	11.0	-8.4	0.48	1.22

Table 10. Linear regression fitting parameters for the dependence of the wind direction standard deviation on the stability parameter, Z/L. The correlation and the uncertainty in the slope are also shown.

Even if Z/L is a good parameter for buoyancy and shear production, it cannot be expected to parameterize mesoscale production. Illustration of this fact is shown in Figure 27, where σ versus Z/L is plotted for stationary conditions. The ranges of the data is small because stationarity does not

coincide with low wind speeds for these experiments. The figure clearly shows that σ is significantly less for stationary conditions due to the absence of mesoscale production. Thus, we should not expect Z/L to correctly parameterize the variability since it cannot account for mesoscale processes.

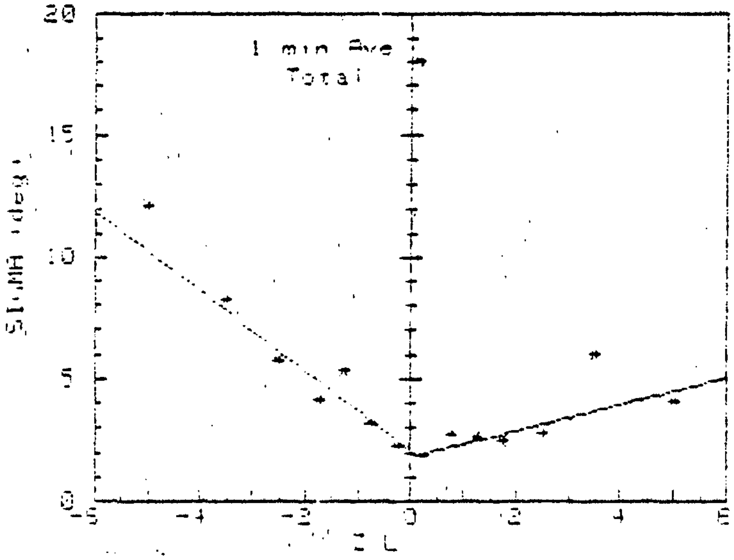
The assumption that stability parameterization cannot fully account for the variability has been checked by sorting the Z/L dependence into wind speed bins, see Figures 28. If Z/L were a sufficient parameter the results would not show any wind speed dependence. The σ versus Z/L data is sorted into three ranges, 0-2 m/sec, 2-4 m/sec and above 6 m/sec. The averaged data points are labeled with a 1, 3, or 6 to indicate the wind speed range. The lines are linear regression fits to the data for the first two ranges and the linear regression fitting parameters are presented in Table 13.

Figure 28 clearly shows that there is a significant contribution to σ which cannot be accounted for by stability. It would be possible to use a scheme where both U and Z/L are seperate (but not independent) parameters. This would not be very satisfying, but Table 11 contains the information to allow one to do so.

Unstable Conditions

Ave Time		U ≤ 2 m/sec Intercept	U ≤ 2 m/sec Slope	2 < U ≤ 4 m/sec Intercept	2 < U ≤ 4 m/sec Slope	U ≥ 6 m/sec Intercept
1m	+Z/L	3.9	0.2	2.0	0.4	2
	-Z/L	3.6	-1.3	2.0	-1.1	2
3m	+Z/L	6.7	0.3	3.7	0.5	2
	-Z/L	6.2	-1.9	3.7	-1.5	3
10m	+Z/L	9.2	1.3	4.9	1.8	3
	-Z/L	9.1	-2.5	5.3	-2.0	4
30m	+Z/L	14.7	1.0	8.5	1.8	4
	-Z/L	15.4	-3.4	9.8	-2.1	7
60m	+Z/L	21		9		6
	-Z/L	25	-4	12	-5	6

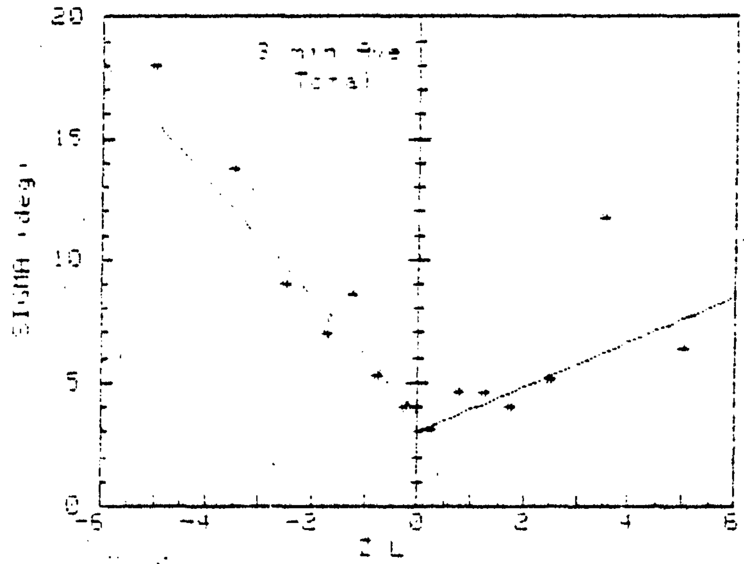
Table 11. Linear regression fitting parameters for the dependence of the wind direction standard deviation on the stability parameter, Z/L, sorted into wind speed ranges of U ≤ 2m, 2 < U ≤ 4, U ≥ 6 m/sec.



Z/L	#	SIGMA	Std Dev
-5.00	10	12.1	5.8
-3.30	8	8.2	3.7
-2.50	21	5.7	1.8
-1.75	21	4.1	1.9
-1.25	23	5.3	4.1
-.75	55	3.1	1.6
-.25	218	2.3	1.2
.25	305	1.9	1.1
.75	32	2.7	2.5
1.25	21	2.6	1.7
1.75	13	2.4	.9
2.50	10	2.7	.9
3.50	3	6.0	2.9
5.00	11	4.1	2.1

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
+ Z/L	1.92	.54	.39	.27
- Z/L	2.05	-1.54	-.66	.07

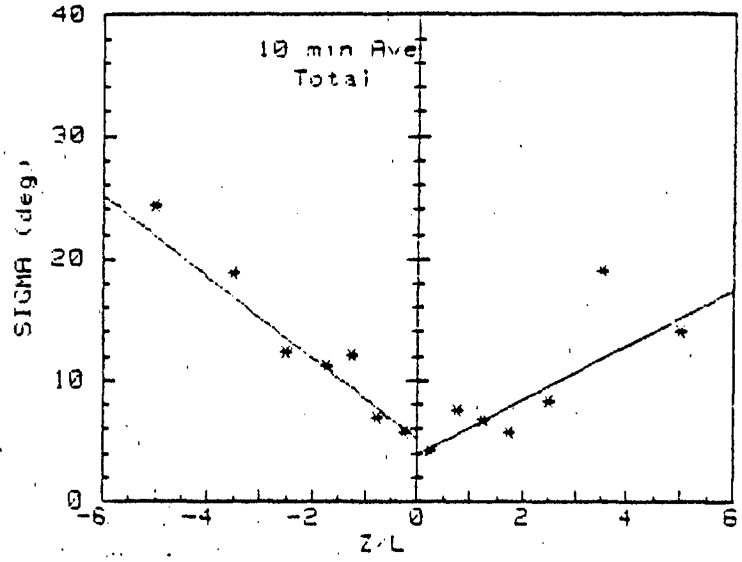
Figure 26. Dependence of the horizontal wind direction standard deviation on the stability parameter Z/L.



Z/L	#	SIGMA	Std Dev
-5.00	10	18.0	8.7
-3.50	9	13.7	5.5
-2.50	21	8.9	3.6
-1.75	21	6.9	3.4
-1.25	23	8.5	5.6
-.75	65	5.2	3.2
-.25	218	4.0	2.5
.25	305	3.1	2.1
.75	38	4.6	4.1
1.25	21	4.5	2.7
1.75	13	4.0	1.8
2.50	10	5.1	2.2
3.50	2	11.7	6.5
5.00	11	6.3	2.4

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
+ Z/L	3.02	.81	.86	.12
- Z/L	3.33	-2.41	-.81	.18

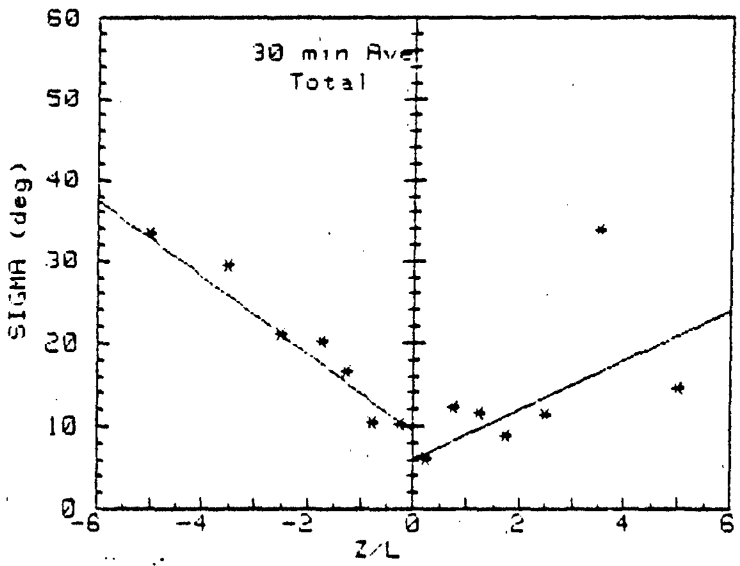
(Figure 26. - continued)



Z/L	#	SIGMA	Std Dev
-5.00	10	24.3	9.9
-3.50	8	18.8	10.3
-2.50	21	12.4	6.9
-1.75	21	11.2	8.9
-1.25	23	12.0	9.8
-.75	64	6.9	4.6
-.25	218	5.6	4.6
.25	305	4.2	3.4
.75	38	7.5	7.7
1.25	21	6.7	3.7
1.75	13	5.7	3.4
2.50	10	8.3	5.7
3.50	3	19.0	14.8
5.00	11	13.9	14.8

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
+ Z/L	3.31	2.26	.44	.23
- Z/L	5.17	-3.33	-.55	.27

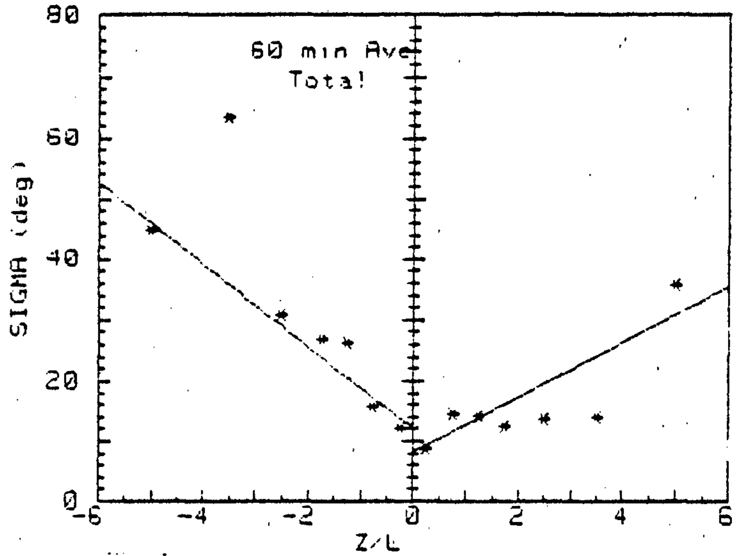
(Figure 26. - continued)



Z/L	#	SIGMA	Std Dev
-5.00	10	33.3	16.7
-3.50	8	29.4	22.7
-2.50	19	20.9	16.3
-1.75	20	20.1	20.2
-1.25	23	16.4	12.7
-.75	64	10.4	9.1
-.25	209	10.2	12.7
.25	263	6.1	5.2
.75	28	12.2	10.5
1.25	19	11.4	9.0
1.75	9	8.7	5.1
2.50	8	11.3	8.0
3.50	3	33.6	23.2
5.00	7	14.4	9.7

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
+ Z/L	6.04	2.97	.36	.41
- Z/L	9.24	-4.69	-.38	.61

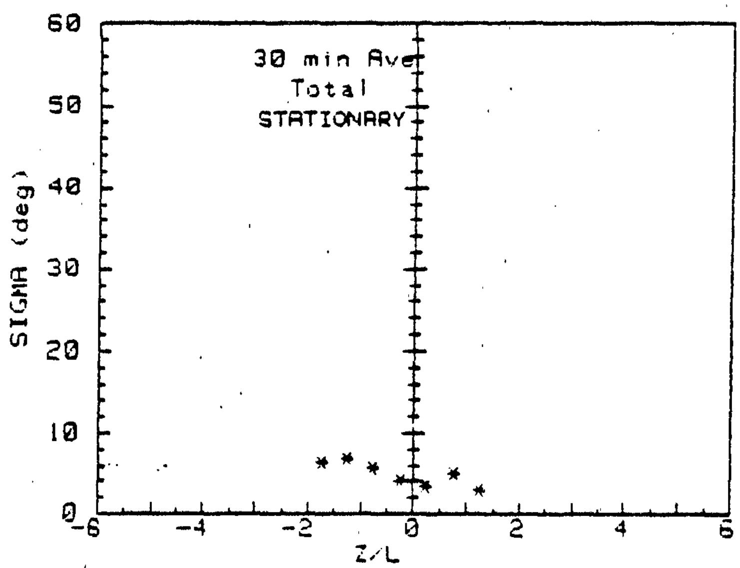
(Figure 26. - continued)



Z/L	#	SIGMA	Std Dev
-5.00	7	44.8	21.6
-3.50	2	63.3	31.2
-2.50	10	30.8	21.9
-1.75	14	26.8	21.0
-1.25	12	26.1	26.5
-.75	24	15.5	12.1
-.25	92	11.9	12.8
.25	120	8.6	7.7
.75	18	14.5	8.7
1.25	6	14.0	6.4
1.75	4	12.3	8.1
2.50	2	13.4	12.1
3.50	1	13.8	0.0
5.00	5	35.6	19.1

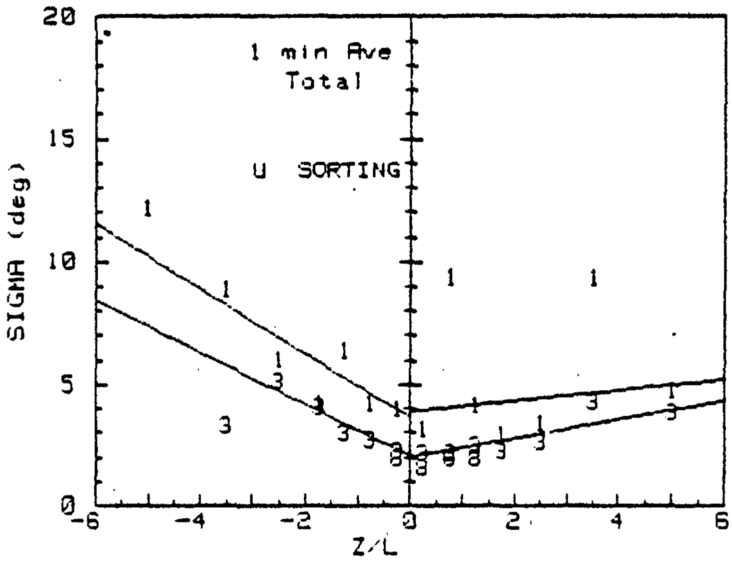
	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
+ Z/L	8.23	4.55	.48	.66
- Z/L	12.02	-6.78	-.48	.97

(Figure 26. - continued)



Z/L	#	SIGMA	Std Dev
-5.00	0	0.0	0.0
-3.50	0	0.0	0.0
-2.50	0	0.0	0.0
-1.75	1	6.3	0.0
-1.25	2	6.7	2.9
-.75	7	5.5	2.0
-.25	63	3.9	1.6
.25	131	3.3	1.8
.75	5	4.9	3.3
1.25	1	3.0	0.0
1.75	0	0.0	0.0
2.50	0	0.0	0.0
3.50	0	0.0	0.0
5.00	0	0.0	0.0

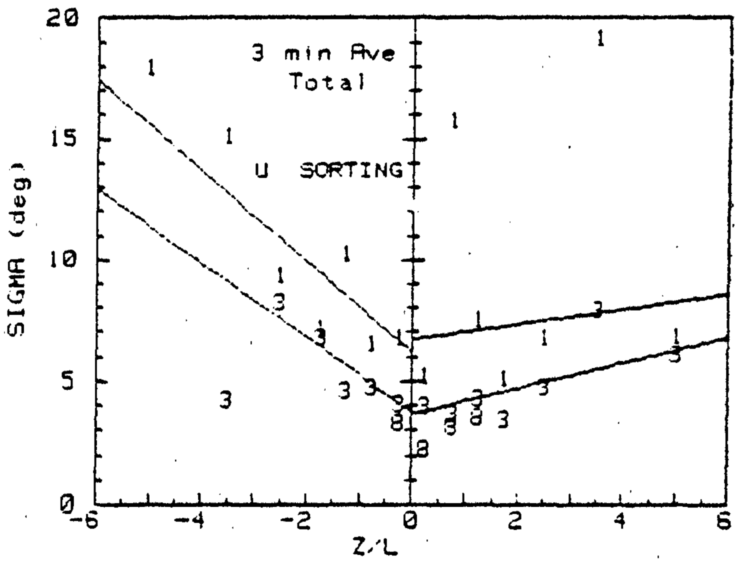
Figure 27. Dependence of the horizontal wind direction standard deviation on the stability parameter Z/L, stationary conditions.



Z/L	#	SIGMA	Std Dev						
-5.0	10	12.1	5.8	0	0.0	0.0	0	0.0	0.0
-3.5	7	8.9	3.4	1	3.3	0.0	0	0.0	0.0
-2.5	14	6.0	1.5	7	5.1	2.3	0	0.0	0.0
-1.8	9	4.2	2.8	12	4.1	1.2	0	0.0	0.0
-1.3	16	5.4	4.6	7	3.0	.9	0	0.0	0.0
-.8	18	4.2	1.3	47	2.7	1.6	0	0.0	0.0
-.3	11	4.0	2.9	144	2.3	1.1	63	2.0	.6
.3	14	3.2	2.4	119	2.2	1.2	172	1.5	.5
.8	3	9.4	3.9	33	2.2	1.3	2	2.0	.6
1.3	2	4.1	1.1	18	2.5	1.7	1	2.0	0.0
1.8	4	2.9	.7	9	2.2	.9	0	0.0	0.0
2.5	2	3.3	1.2	8	2.6	.8	0	0.0	0.0
3.5	1	9.4	0.0	2	4.3	.3	0	0.0	0.0
5.0	3	4.8	2.2	8	3.8	2.1	0	0.0	0.0

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
U = 1 m/sec				
+ Z/L	3.89	.22	.16	.26
- Z/L	3.63	-1.32	-.54	.22
U = 3 m/sec				
+ Z/L	2.01	.39	.31	.09
- Z/L	2.04	-1.07	-.44	.15

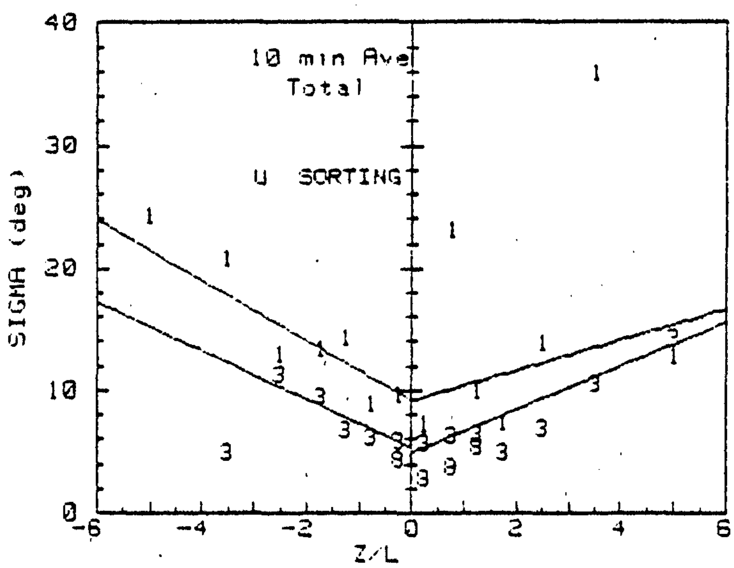
Figure 28. Dependence of the horizontal wind direction standard deviation on the stability parameter Z/L sorted into the wind speed ranges U ≤ 2 m/sec (1), 2 < U ≤ 4 m/sec (3), U ≥ 6 m/sec (8).



Z/L	#	SIGMA	Std Dev						
-5.0	10	18.0	8.7	0	0.0	0.0	0	0.0	0.0
-3.5	7	15.1	5.7	1	4.2	0.0	0	0.0	0.0
-2.5	14	9.3	3.3	7	8.2	4.4	0	0.0	0.0
-1.8	9	7.2	4.7	12	6.7	2.3	0	0.0	0.0
-1.3	16	10.2	7.2	7	4.6	1.5	0	0.0	0.0
-.8	18	6.5	2.0	47	4.8	3.4	0	0.0	0.0
-.3	11	6.7	5.6	144	4.1	2.3	63	3.3	2.0
.3	14	5.2	3.5	119	4.0	2.5	172	2.2	.9
.8	3	15.8	4.8	33	3.7	2.4	2	3.1	.7
1.3	2	7.5	.1	18	4.3	2.7	1	3.5	0.0
1.8	4	5.1	2.4	9	3.5	1.3	0	0.0	0.0
2.5	2	6.8	4.6	8	4.7	1.4	0	0.0	0.0
3.5	1	19.2	0.0	2	7.9	0.0	0	0.0	0.0
5.0	3	6.9	2.6	8	6.1	2.5	0	0.0	0.0

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
U = 1 m/sec				
+ Z/L	6.73	.31	.13	.44
- Z/L	6.17	-1.88	-.49	.37
U = 3 m/sec				
+ Z/L	3.69	.52	.23	.16
- Z/L	3.73	-1.53	-.33	.30

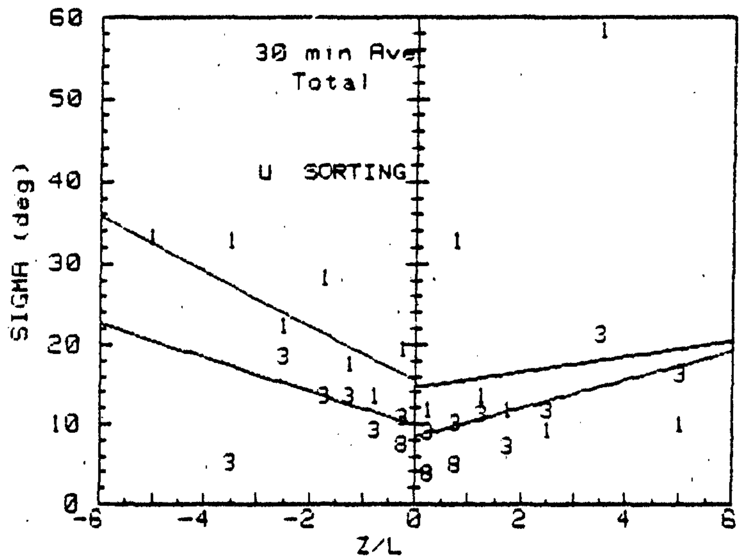
(Figure 28. - continued)



Z/L	#	SIGMA	Std Dev						
-5.0	10	24.3	9.9	0	0.0	0.0	0	0.0	0.0
-3.5	7	20.8	9.4	1	4.9	0.0	0	0.0	0.0
-2.5	14	13.0	6.4	7	11.2	8.0	0	0.0	0.0
-1.8	9	13.4	12.3	12	9.5	5.3	0	0.0	0.0
-1.3	16	14.3	10.9	7	6.7	3.1	0	0.0	0.0
-.8	18	8.9	3.0	46	6.1	4.8	0	0.0	0.0
-.3	11	9.7	8.2	144	5.9	4.1	63	4.3	4.2
.3	14	7.2	4.2	119	5.7	4.0	172	2.8	2.0
.8	3	23.0	9.4	33	6.3	6.2	2	3.7	1.1
1.3	2	9.9	1.8	18	6.5	3.8	1	5.3	0.0
1.8	4	7.3	5.8	9	4.9	1.6	0	0.0	0.0
2.5	2	13.9	13.0	8	6.9	2.5	0	0.0	0.0
3.5	1	36.0	0.0	2	10.5	2.1	0	0.0	0.0
5.0	3	12.9	10.2	8	14.3	16.8	0	0.0	0.0

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
U = 1 m/sec				
+ Z/L	9.17	1.25	.30	.76
- Z/L	9.14	-2.47	-.44	.56
U = 3 m/sec				
+ Z/L	4.93	1.78	.34	.36
- Z/L	5.31	-1.98	-.25	.52

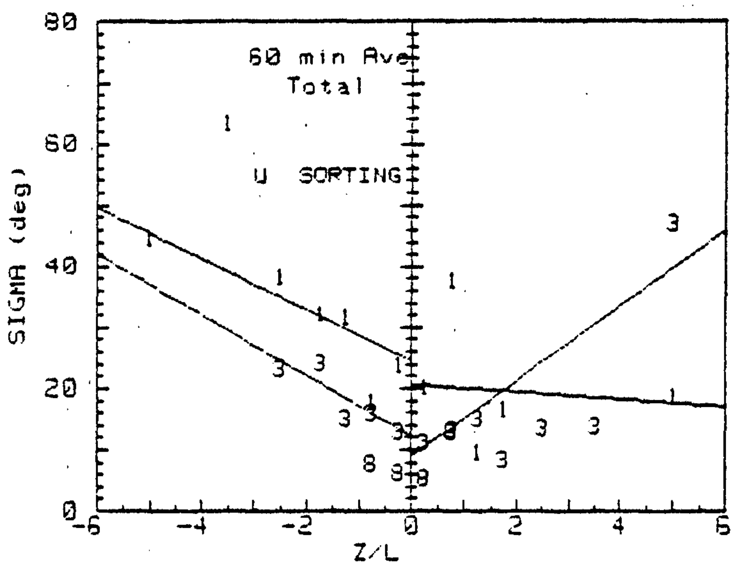
(Figure 28. - continued)



Z/L	#	SIGMA	Std Dev						
-5.0	10	33.3	16.7	0	0.0	0.0	0	0.0	0.0
-3.5	7	32.8	22.1	1	5.2	0.0	0	0.0	0.0
-2.5	12	22.4	14.0	7	18.4	20.7	0	0.0	0.0
-1.8	9	28.2	26.9	11	13.4	9.4	0	0.0	0.0
-1.3	16	17.6	13.6	7	13.4	10.5	0	0.0	0.0
-.8	18	13.6	6.0	46	9.2	9.9	0	0.0	0.0
-.3	10	19.5	21.1	139	10.8	11.2	60	7.4	13.7
.3	14	11.7	7.3	99	8.9	6.0	150	3.7	2.3
.8	3	32.9	15.4	23	10.2	6.8	2	5.0	.2
1.3	2	13.5	2.0	17	11.2	9.5	0	0.0	0.0
1.8	3	11.6	8.1	6	7.2	2.9	0	0.0	0.0
2.5	1	9.3	0.0	7	11.6	8.6	0	0.0	0.0
3.5	1	58.5	0.0	2	21.2	12.1	0	0.0	0.0
5.0	2	10.0	2.6	5	16.1	11.2	0	0.0	0.0

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
U = 1 m/sec				
+ Z/L	14.66	.97	.13	1.54
- Z/L	15.35	-3.42	-.34	1.07
U = 3 m/sec				
+ Z/L	8.49	1.78	.25	.56
- Z/L	9.78	-2.13	-.11	1.31

(Figure 28. - continued)



Z/L	#	SIGMA	Std Dev						
-5.0	7	44.8	21.6	0	0.0	0.0	0	0.0	0.0
-3.5	2	63.3	31.2	0	0.0	0.0	0	0.0	0.0
-2.5	5	38.3	23.4	5	23.2	19.5	0	0.0	0.0
-1.8	5	32.1	15.4	9	23.9	23.8	0	0.0	0.0
-1.3	8	31.7	29.6	4	15.1	16.9	0	0.0	0.0
-.8	5	17.6	7.4	17	15.8	13.7	2	7.8	2.1
-.3	7	23.7	29.9	60	12.9	10.9	25	6.1	5.4
.3	10	20.1	6.9	41	11.2	8.5	69	5.4	4.6
.9	1	37.7	0.0	16	13.2	7.0	1	12.9	0.0
1.3	1	9.5	0.0	5	14.9	6.8	0	0.0	0.0
1.8	2	16.5	10.5	2	8.2	4.2	0	0.0	0.0
2.5	0	0.0	0.0	2	13.4	12.1	0	0.0	0.0
3.5	0	0.0	0.0	1	13.8	0.0	0	0.0	0.0
5.0	2	13.5	14.7	3	47.0	11.5	0	0.0	0.0

	INTERCEPT	SLOPE	CORRELATION	DELTA SLOPE
U = 1 m/sec				
+ Z/L	20.66	-.61	-.14	1.17
- Z/L	24.50	-4.18	-.35	1.86
U = 3 m/sec				
+ Z/L	9.01	6.17	.61	.37
- Z/L	12.10	-4.99	-.24	2.07

(Figure 28. - continued)

ONSHORE/OFFSHORE INFLUENCE

One would expect that, all else being equal, the turbulence would be larger for offshore flow due to enhancement by the terrain and the transition from the overland to the over water regime. Here we compare onshore and offshore flow; the analysis is not very reliable because only a small amount of offshore data exist and none of it is for high wind speeds.

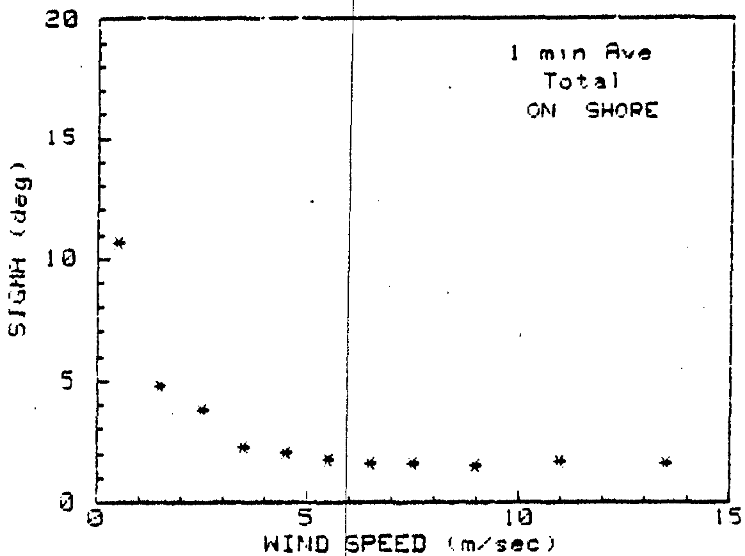
Variabilities as functions of wind speed for onshore and offshore flow are shown in Figures 29. The following table presents the differences in σ for these conditions.

σ_θ(offshore) - σ_θ(onshore) (deg)

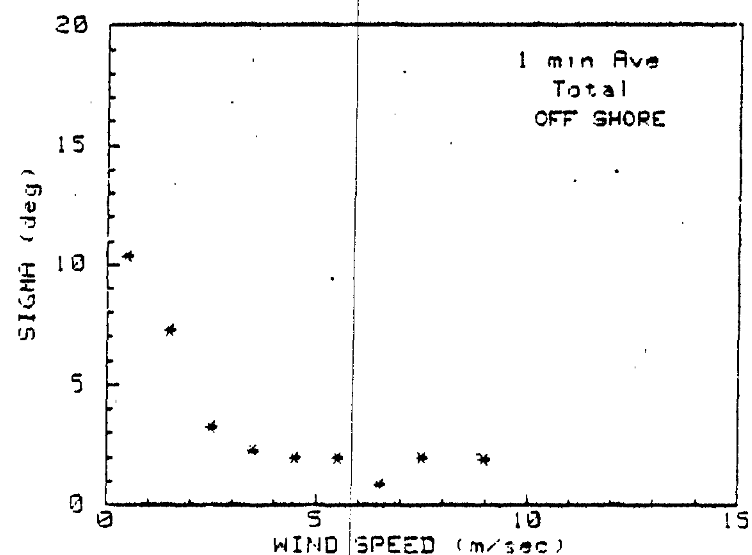
U(m/sec)	T_{ave} = 1m	3m	10m	30m	60m
0.5	-0.3	3.1	-0.2	17.9	7.8
1.5	2.4	4.3	5.9	8.4	4.8
2.5	-0.6	-1.2	-1.8	-0.8	-1.5
3.5	0	-0.4	0	3.0	0.4
4.5	-0.1	-0.9	-1.3	-1.3	3.7
5.5	0.3	0.1	0.4	2.1	6.7
7.5	0.3	0.8	1.3	1.8	2.1
9.0	0.3	0.9	0.6	2.4	0.5

Table 12. Differences in the horizontal wind direction standard deviations for onshore and offshore flow.

The results in the table are not very encouraging. There is a pattern of increasing averaging time and decreasing wind speed. The percent differences are small and we feel that no attempt should be made to take this effect into account unless one is near the shore. We do not have any near shore, offshore flow data.

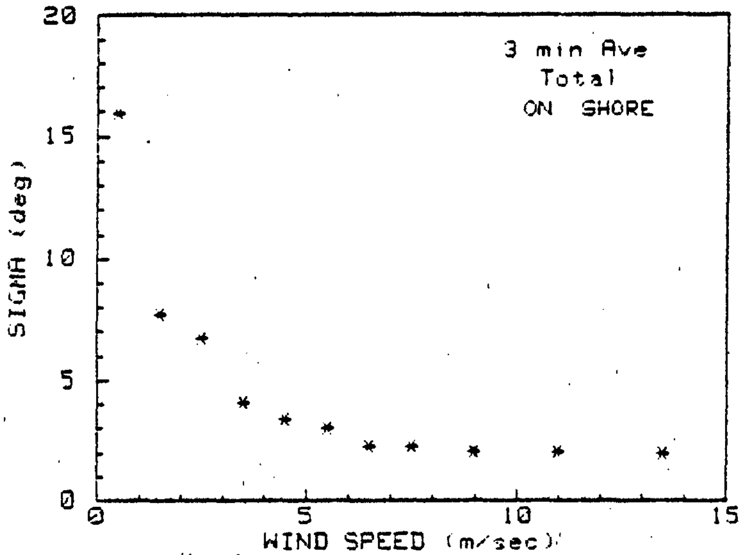


U	#	SIGMA	Std Dev
.5	8	10.6	8.5
1.5	28	4.8	3.5
2.5	67	3.9	2.0
3.5	77	2.3	1.3
4.5	94	2.0	.9
5.5	77	1.7	.6
6.5	59	1.5	.5
7.5	45	1.5	.4
9.0	29	1.5	.4
11.0	17	1.6	.3
13.5	14	1.5	.1

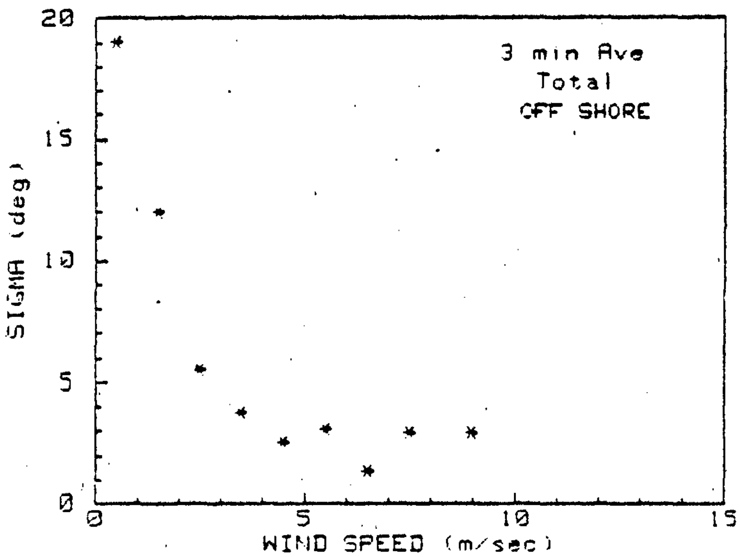


U	#	SIGMA	Std Dev
.5	3	10.3	6.5
1.5	23	7.2	5.1
2.5	32	3.2	1.9
3.5	17	2.3	1.0
4.5	7	1.9	.4
5.5	5	2.0	.7
6.5	2	.8	0.0
7.5	4	1.9	.5
9.0	5	1.9	.2
11.0	0	0.0	0.0
13.5	0	0.0	0.0

Figure 29. Dependence of the horizontal wind direction standard deviation on wind speed for onshore and offshore flow.

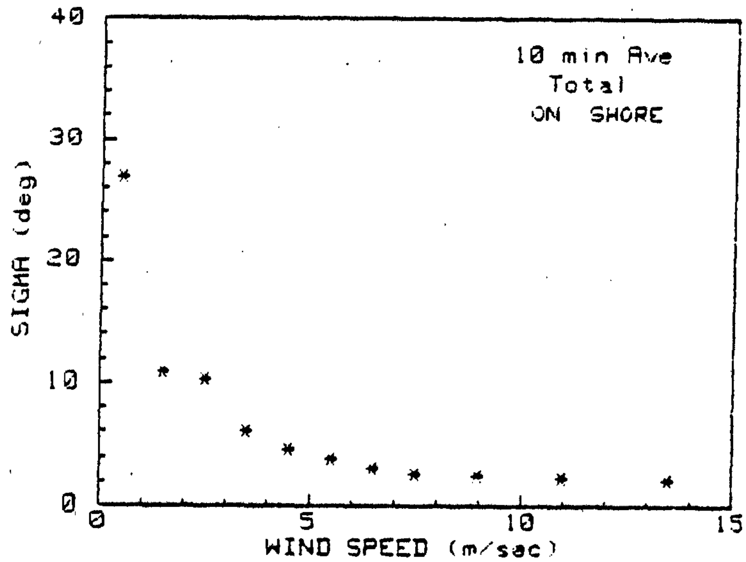


U	#	SIGMA	Std Dev
.5	8	15.9	10.0
1.5	28	7.7	5.7
2.5	67	6.7	3.5
3.5	77	4.1	2.8
4.5	94	3.4	1.7
5.5	77	3.0	1.4
6.5	58	2.3	.9
7.5	45	2.2	.6
9.0	29	2.0	.5
11.0	17	2.0	.6
13.5	14	2.0	.2

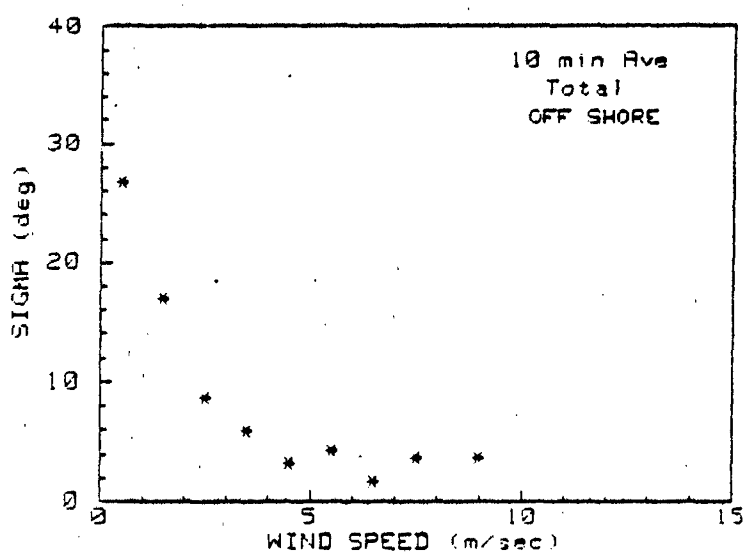


U	#	SIGMA	Std Dev
.5	3	19.0	10.4
1.5	23	12.0	8.2
2.5	32	5.5	3.8
3.5	17	3.7	1.8
4.5	7	2.5	.7
5.5	5	3.1	1.0
6.5	2	1.4	.2
7.5	4	3.0	.8
9.0	5	2.9	.5
11.0	0	0.0	0.0
13.5	0	0.0	0.0

(Figure 29. - continued)

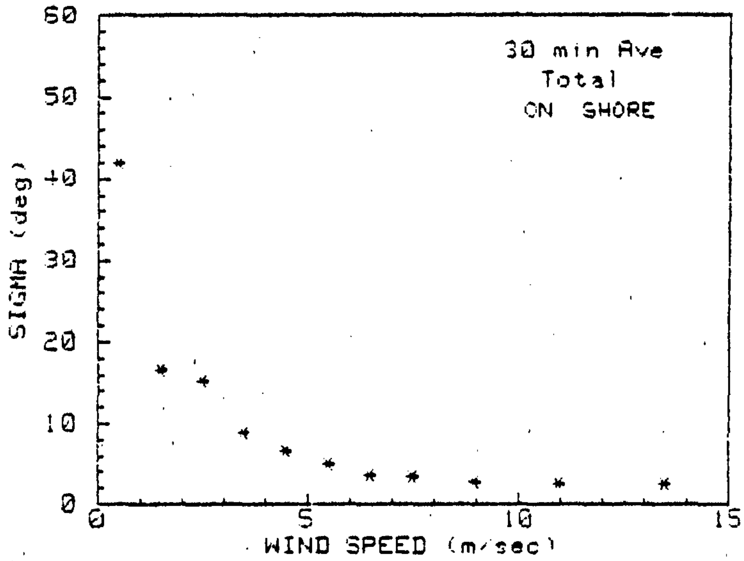


U	#	SIGMA	Std Dev
.5	8	26.9	13.3
1.5	28	10.9	8.2
2.5	67	10.3	9.0
3.5	76	5.9	5.0
4.5	93	4.4	2.4
5.5	77	3.7	2.1
6.5	59	3.0	1.7
7.5	45	2.6	.9
9.0	29	2.3	.5
11.0	17	2.2	.7
13.5	14	2.1	.2

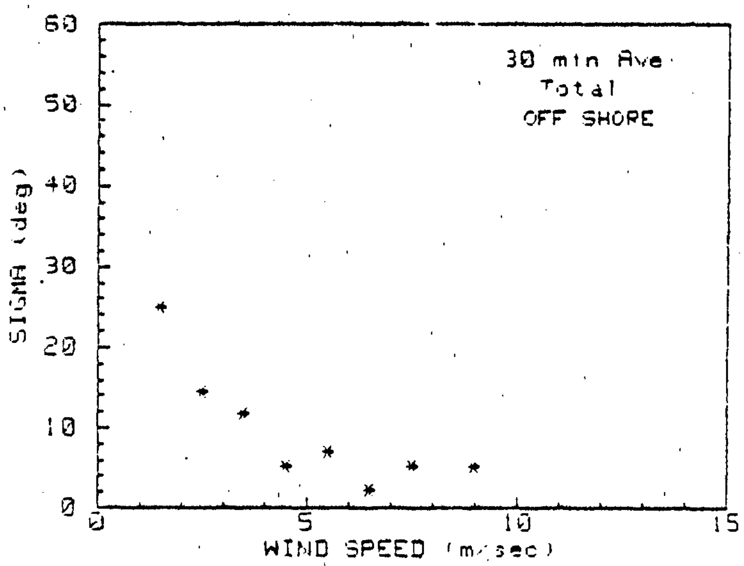


U	#	SIGMA	Std Dev
.5	3	26.6	9.0
1.5	23	16.8	11.8
2.5	32	8.5	6.4
3.5	17	5.9	3.4
4.5	7	3.1	.7
5.5	5	4.1	1.7
6.5	2	1.7	0.0
7.5	4	3.6	1.2
9.0	5	3.5	1.3
11.0	0	0.0	0.0
13.5	0	0.0	0.0

(Figure 29. - continued)

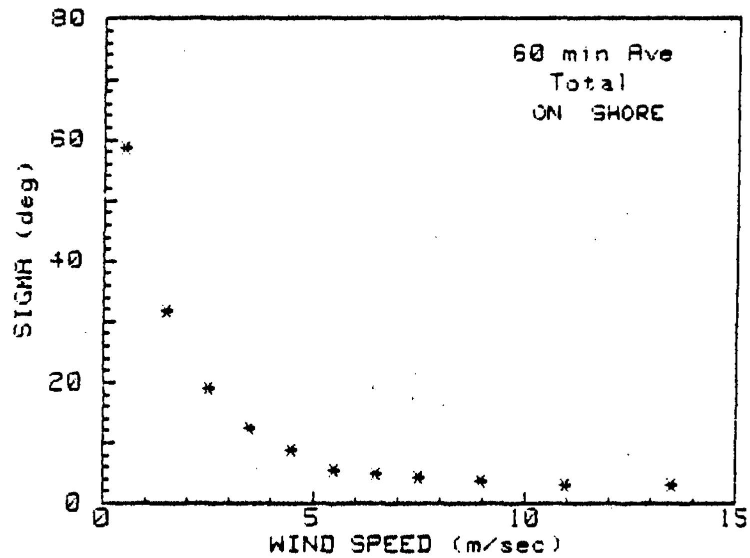


U	#	SIGMA	Std Dev
.5	7	41.8	23.1
1.5	28	15.4	14.3
2.5	60	15.2	11.2
3.5	65	8.8	9.5
4.5	83	6.5	3.8
5.5	71	4.9	2.5
6.5	49	3.6	1.3
7.5	38	3.3	1.2
9.0	29	2.7	.7
11.0	16	2.5	.9
13.5	13	2.3	.5

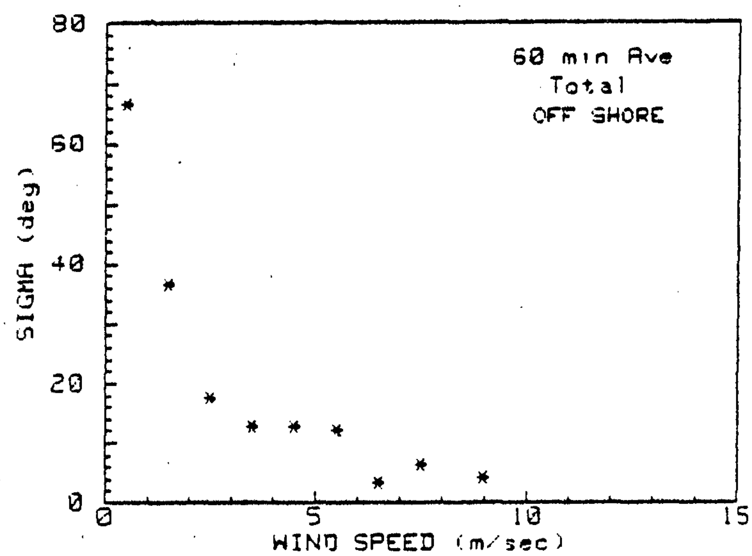


U	#	SIGMA	Std Dev
.5	3	63.7	20.0
1.5	22	24.8	15.9
2.5	27	14.4	13.5
3.5	14	11.8	9.5
4.5	6	5.2	2.1
5.5	5	6.9	3.9
6.5	2	2.3	.7
7.5	4	5.1	1.1
9.0	5	5.1	2.5
11.0	0	0.0	0.0
13.5	0	0.0	0.0

(Figure 29. - continued)



U	#	SIGMA	Std Dev
.5	3	58.7	19.8
1.5	14	31.6	22.4
2.5	26	19.0	14.2
3.5	33	12.3	12.4
4.5	41	8.7	4.9
5.5	26	5.3	2.6
6.5	20	4.6	2.1
7.5	17	4.1	1.9
9.0	14	3.5	1.5
11.0	6	2.8	1.4
13.5	6	3.0	.9



U	#	SIGMA	Std Dev
.5	1	66.5	0.0
1.5	10	36.4	29.4
2.5	14	17.5	13.4
3.5	9	12.7	5.8
4.5	3	12.4	8.2
5.5	1	12.0	0.0
6.5	1	3.1	0.0
7.5	3	6.2	2.0
9.0	1	4.0	0.0
11.0	0	0.0	0.0
13.5	0	0.0	0.0

(Figure 29. - continued)

VIII. PARAMETERIZATION RESULTS.

The results in the previous section show the wind direction variability magnitudes that can be attributed to the three production mechanisms, shear, buoyancy, and mesoscale processes. We have shown that it is not possible to unambiguously separate the mechanisms. We now develope the parameterization by fitting Equation 20 to the data, adjusting C_w and C_U to find the best fit. This is done for all five averaging times, 1 min, 3 min, 10 min, 30 min, and 60 min.

The mesoscale process cannot be parameterized with C_w and C_U, so another term must be added to Equation 20. We have seen that the mesoscale influence decreases with increasing wind speed, and we use

$$\sigma_\theta(\text{mesoscale}) = C_{ms} / U^N .$$

If $N = 2$, C_{ms} can be interpreted as the square of an effective mixing velocity, equivalent to the convective mixing velocity, w_*, and the friction velocity U_*. Understanding this new velocity is not easy, and here we only evaluate the new constants with no explanation of their meaning. Figures 30 show the theoretical fits to the σ vs. U data for stable, stationary, and unrestricted conditions. Sorting on w_* ranges of 0-0.2, 0.2-0.4, and > 0.4 m/sec is done for th~ latter two cases and the values of the fitting parameters used are shown on the graphs.

These particular conditions have been chosen because a) $w_* = 0$ for stable conditions and C_{ms} can be determined, b) mesoscale production is low for stationary conditions and C_w can be determined, and c) the whole procedure can be checked for unrestricted conditions. For each set of curves the parameters are evaluated by the following procedure.

1. Choose an initial value of C_U from Table 9.
2. Adjust C_{ms} and N to fit the low wind speed portion of the stable data.
3. Adjust C_U to correctly fit the high wind speed portion of the stable data.
4. Choose C_w from Table 9 and adjust to fit the stationary data.
5. The above procedures utilize data for which $C_w = 0$ and $C_{ms} = 0$, respectively. Now check the results by checking the fit that all parameters combined give to the unrestricted data.

There are two fitting curves for those cases where $C_w = 0$. The lower one is for $w_* = 0.1$ and the upper 0.5 m/sec. These curves correspond reasonably well to the values of σ found for the low and high w_* ranges, 0-0.1 m/sec and 0.4 m/sec and greater.

We have found that the best value of N for the mesoscale term is N = 2. This is convenient since it may allow future development of a model with a new scaling velocity. Such modeling is well beyond the scope of this report.

We have discovered during the course of fitting the data that the short-time average results are strongly dependent on the value of C_U while the long-time average results are not. This is illustrated in Figures 31 where we attempt to fit the 1 min and 60 min data with only slight changes in the parameters. For the 1 min data, such fitting is not possible. The low wind speed data can be fit by slightly raising C_{ms}, or the high wind speed data by lowering N. Both ranges cannot be fit without including C_U. The conclusion is that shear production is not important for large averaging times, large scale processes dominate. For short averaging times, shear production dominates at high wind speeds.

The formulation we are using to fit the data takes stability into account through the term F(L), which we have assumed to be 1.0 to this point. This correction has been applied and the effect is illustrated in Figures 32. The figures use the parameters determined above, and plot the theoretical results for $Z/L = -4$, 0, and +4. For a 1 min averaging time, the theory predicts and the plots show supression of variability for stable conditions and enhancement for unstable. The effect is negligible for a 30 min averaging time. Even for short averaging times the effect is only noticible for high wind speeds, and oversea conditions do not support stability far from nuetral for high winds. Thus, we conclude that the stability correction is not needed for the values of C_U, C_w and C_{ms} that correctly fit these data and will continue to use $F(L) = 1$.

The next section summarizes these results and discusses their meaning.

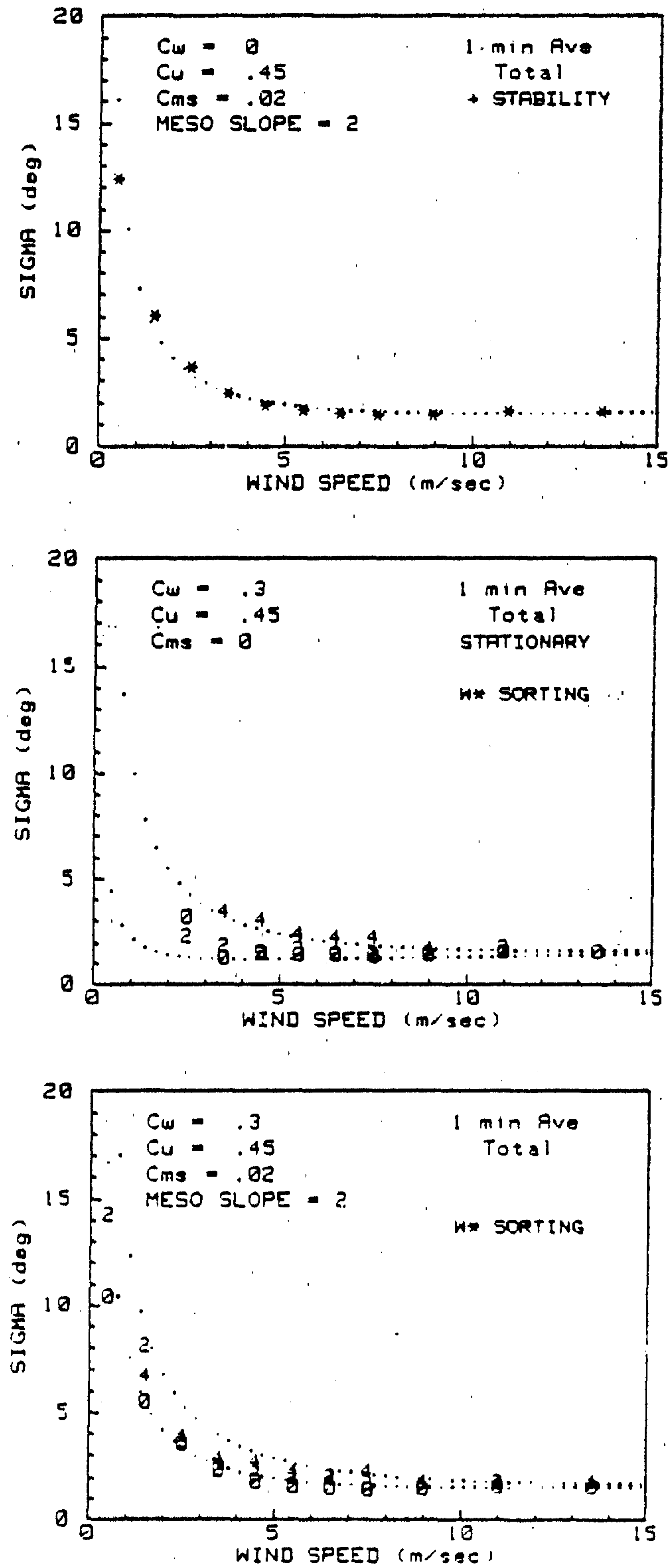
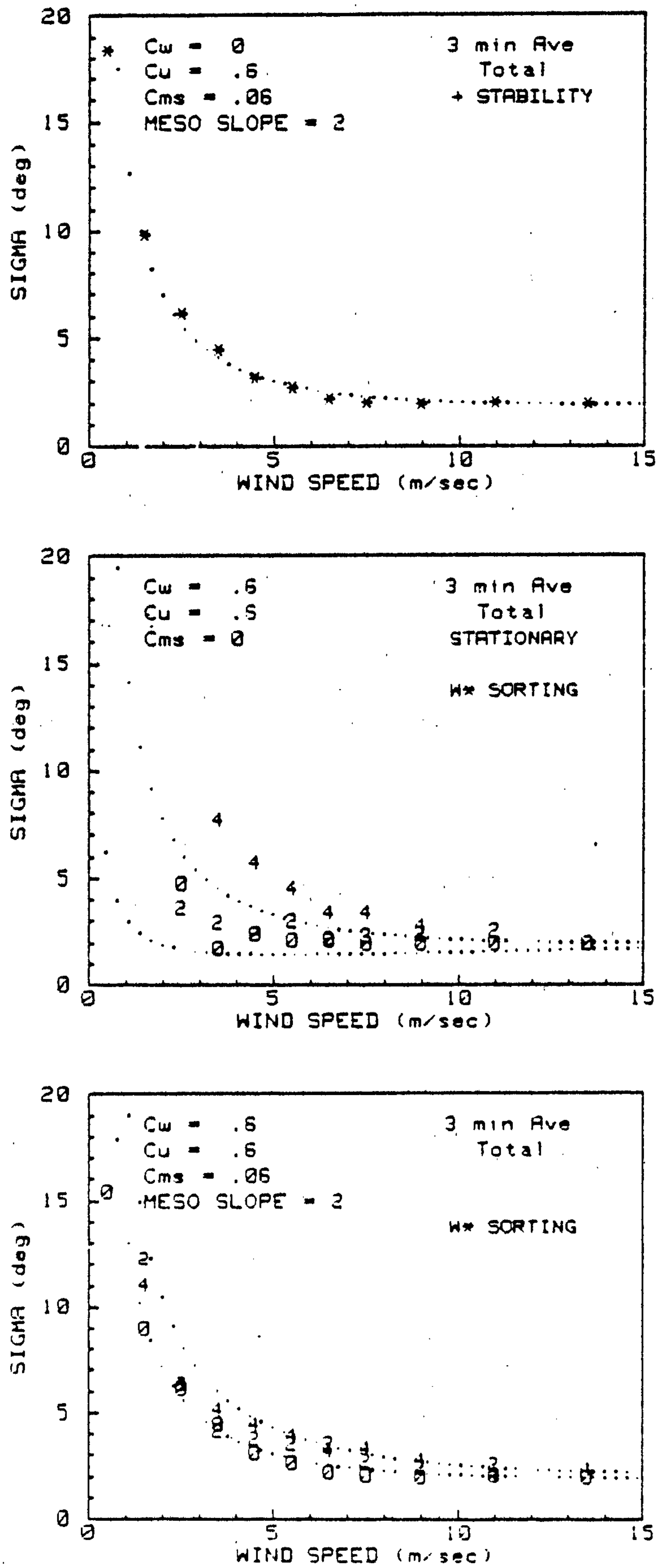
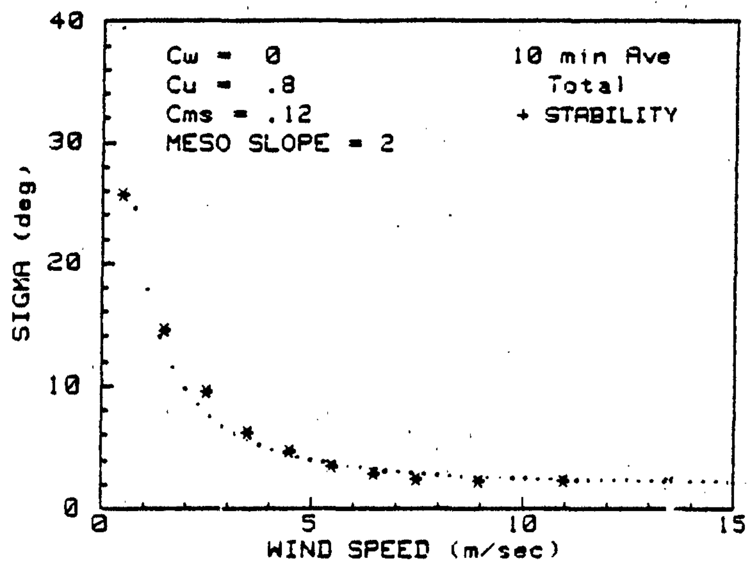
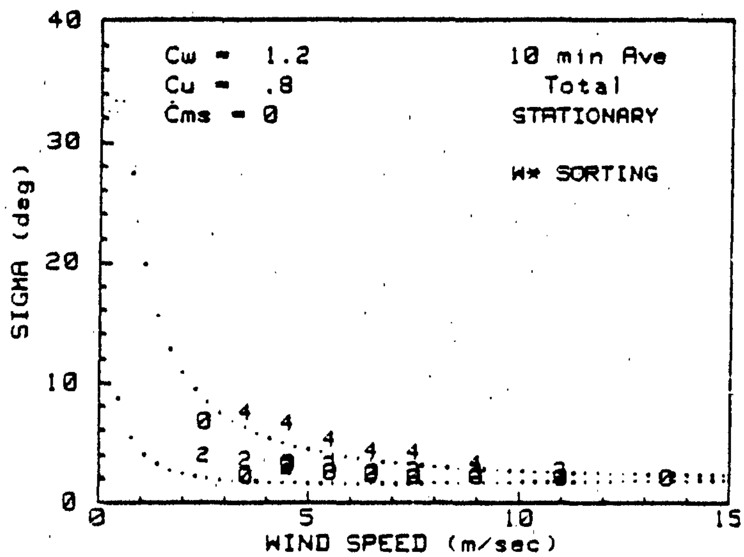


Figure 30. Fits of the theory (dots) to the σ_θ vs. U data for stable, stationary, and all conditions.

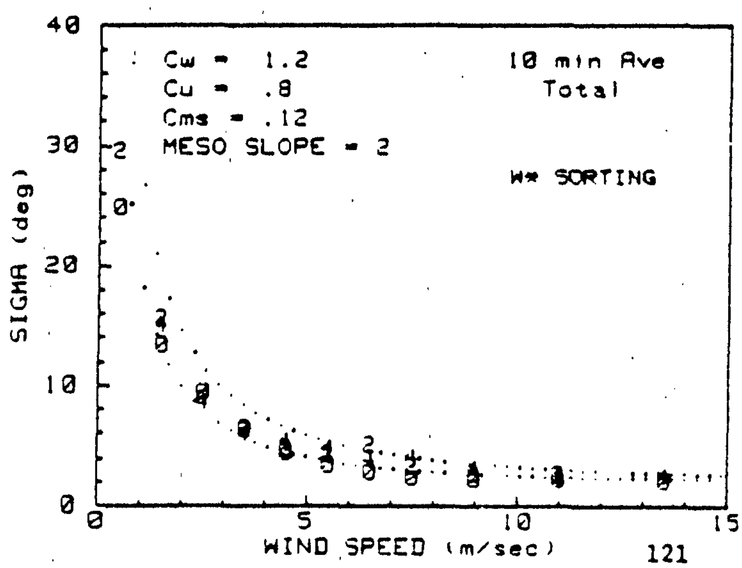


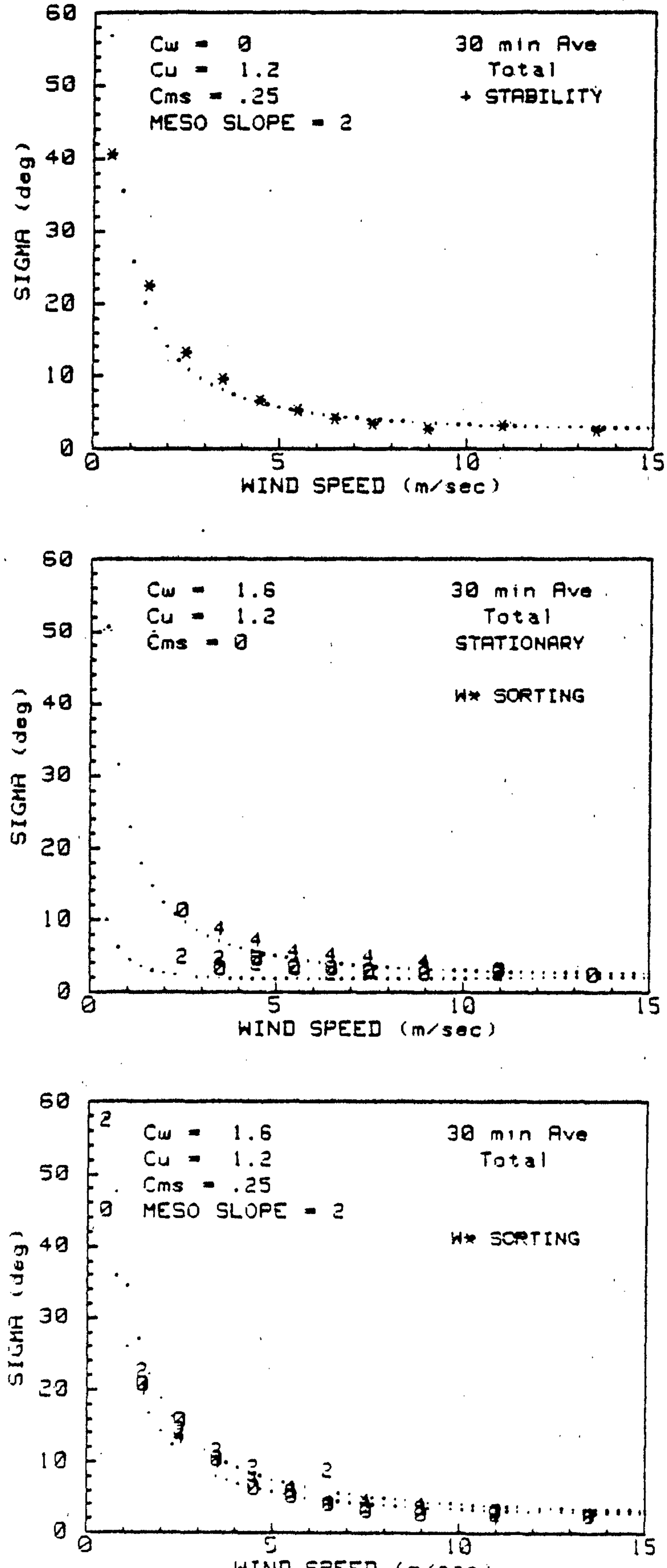
(Figure 30. - continued)



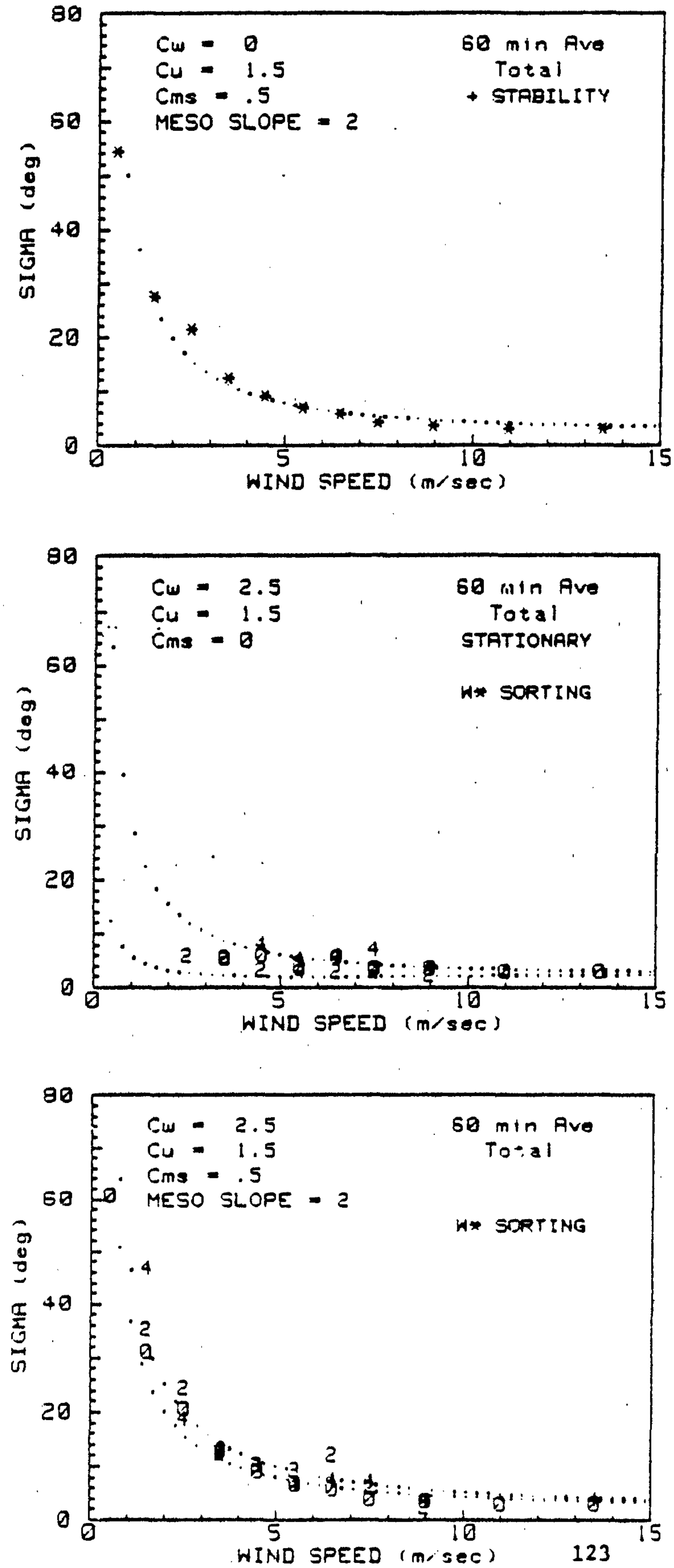


(Figure 30. - continued)

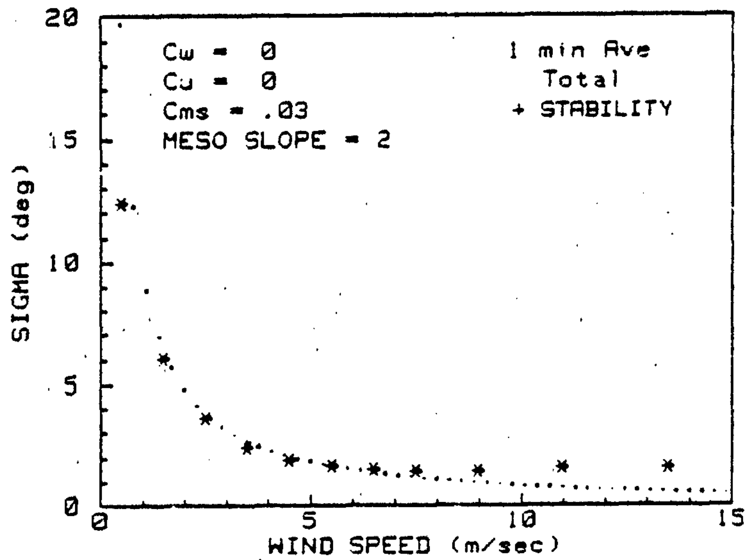


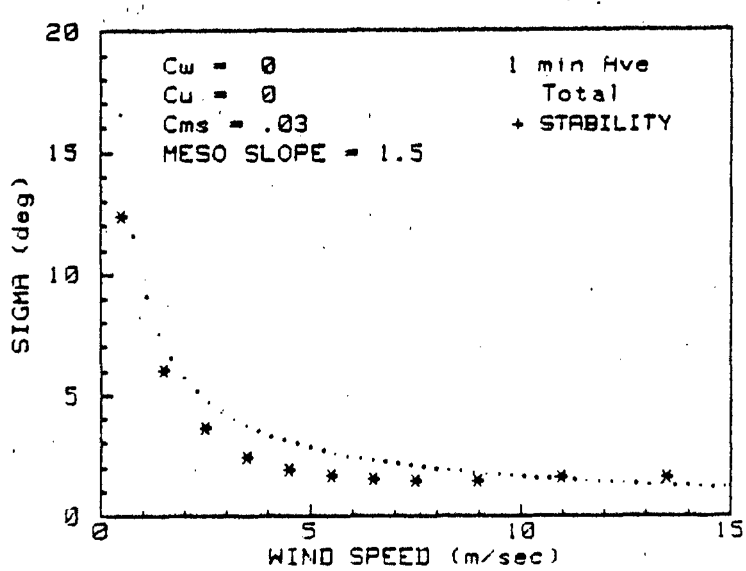


(Figure 30. - continued)

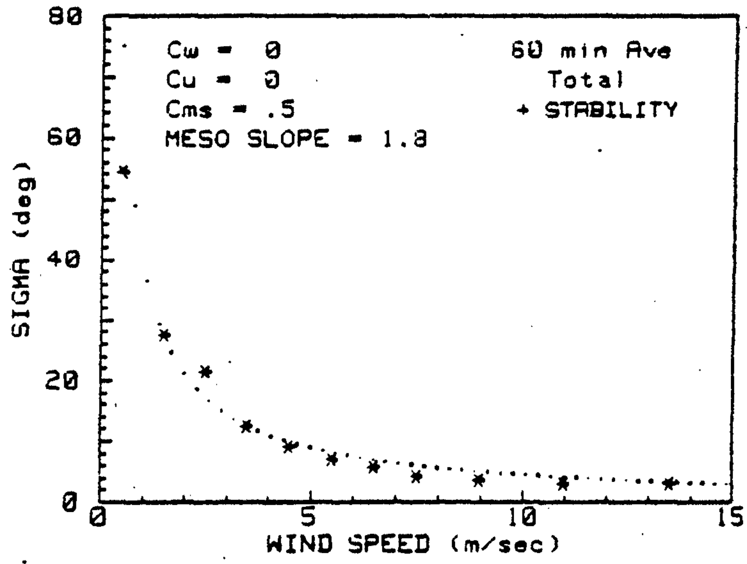


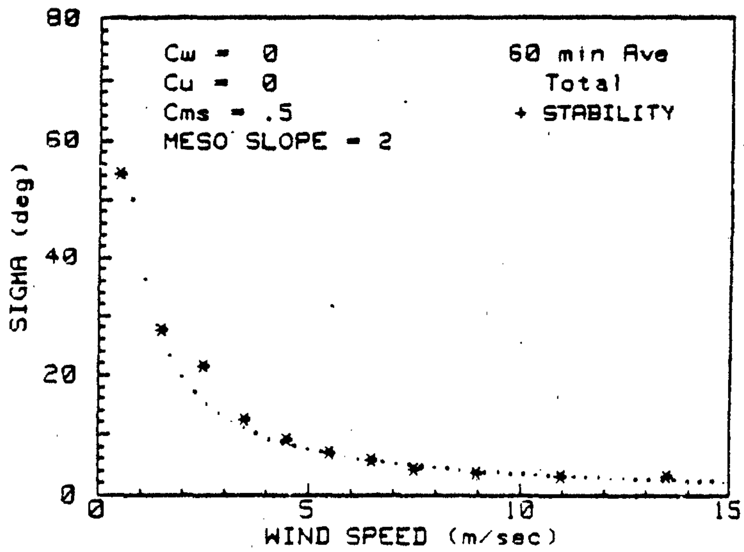
(Figure 30. - continued)





Figures 31. Attempts to fit 1 min and 60 min average σ_Θ vs. U data with only mesoscale production.





(Figure 31. - continued)

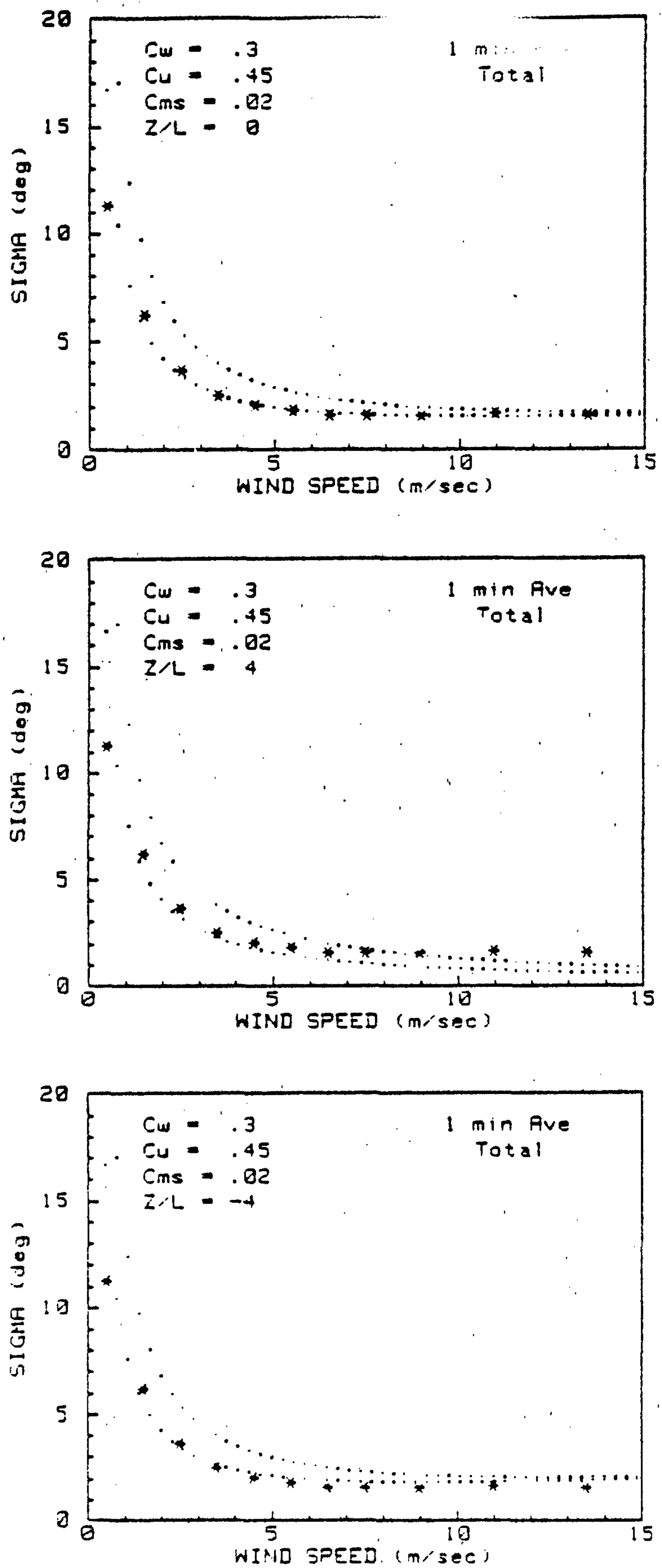
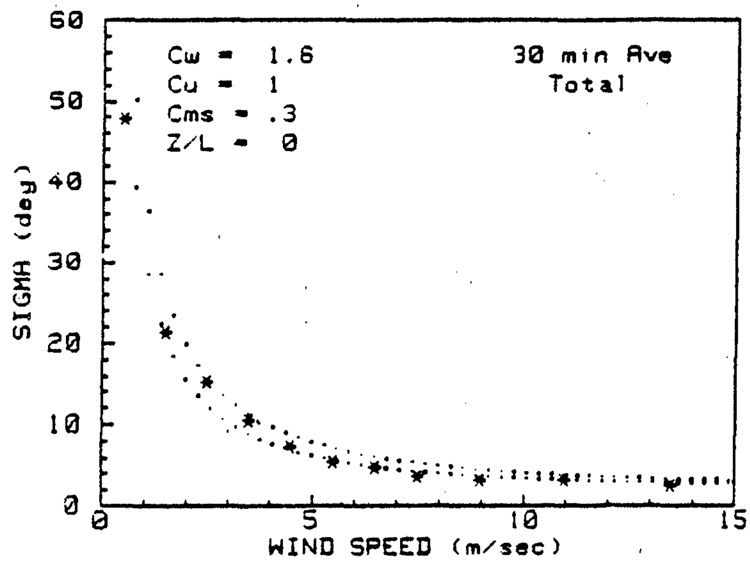
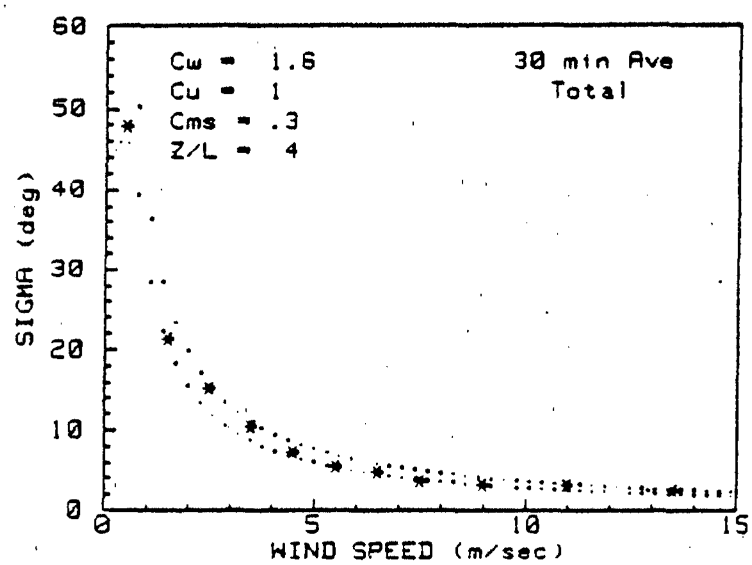
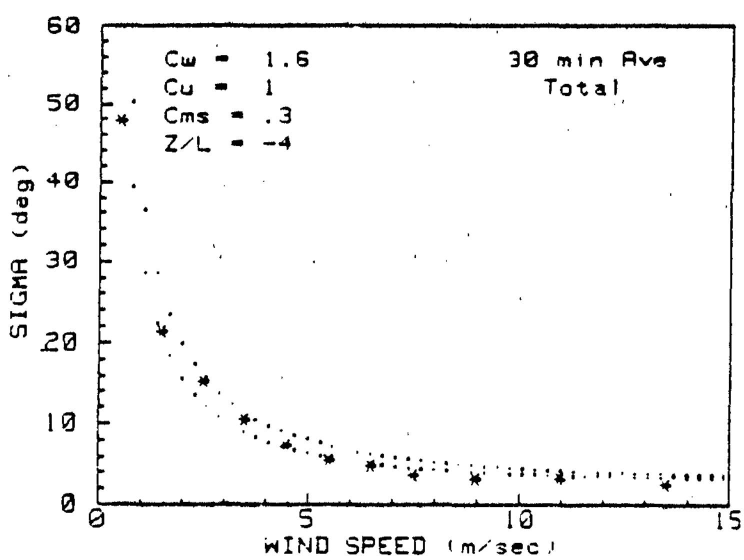


Figure 32. Variation of the theoretical fits tc σ_θ vs. U with stabi 1 min and 30 min av





(Figure 32. - continued)



IX. SUMMARY AND DISCUSSION.

We have parameterized the horizontal wind variability with the equation

$$\sigma_\theta^2 = C_w\, k^{2/3}\, (w_*/U)^2 + C_U (U_*/U)^2 + C_{ms}/U^2. \qquad (23)$$

The three fitting parameters are functions of the averaging time used to evaluate the variance. The values of the parameters are given in the following table.

Ave Time	C_w	C_U	C_{ms}
1 min	0.3	0.45	0.02
3 min	0.6	0.6	0.06
10 min	1.2	0.8	0.12
30 min	1.6	1.2	0.25
60 min	2.5	1.5	0.5

Table 13. Fitting parameters for buoyancy, shear, and mesoscale production.

Some care must be exercised in using the equation and parameters. The following caveats apply:

1. These results are only applicable to the coastal, overwater regime.

2. These results may be location specific (although two reasonably different locations were utilized for data collection).
3. The mesoscale production term was obtained by examining data when the flow was driven by a sea-breeze cycle. It cannot be expected to apply to other conditions.
4. The mesoscale term must be set to zero, $C_{ms} = 0$, for stationary conditions.

We have reasonable confidence that the buoyancy and shear production terms are transportable to other conditions and locations. There may be some difficulty with the buoyancy term because we cannot be sure that all mesoscale influence was absent when it was determined, but it's use as given should not lead to significant error. We have no confidence that the mesoscale term is transportable. The effect is large and we expect it to be site specific.

Flat terrain overland can often be characterized by an 0.2 power law relation for σ vs. T_{ave}. We can easily check that relationship for these conditions using the parameters presented in Table 13. The results are presented in the following table.

	1m	3m	10m	30m	60m
$(T/T_1)^{0.2}$	1.0	1.25	1.58	1.97	2.26
$(C_w/C_w(1))^{1/2}$	1.0	1.4	2.0	2.3	2.9
$(C_U/C_U(1))^{1/2}$	1.0	1.15	1.3	1.6	1.8
$(C_{ms}/C_{ms}(1))^{1/2}$	1.0	1.7	2.4	3.5	5.0

Table 14. Comparison of the ratio of wind direction standard deviation for buoyancy, shear, and mesoscale production for various averaging times with the 0.2 power law.

It is obvious that none of the terms follow the 0.2 power law. Each term does follow a power law fairly well, with the following exponents:

Buoyancy	0.27
Shear	0.13
Mesoscale	0.38

The right combination of shear and buoyancy production can lead to an 0.2 power law. Of course, depending on the conditions, any value between the extremes shown above can be found, or non-power law behavior. This indicates that there is a significant difference in the shape of the turbulence spectra for flat overland terrain and a coastal region, a not unexpected result.

It is also possible to parameterize the wind variability

with the surface layer stability. This parameterization was presented in section VI and will not be repeated here. We do want to reemphasize that Z/L can only be a good parameter for stationary conditions, which restricts its usefulness to near neutral conditions. This is due to the inability to parameterize mesoscale production in this way.

The purpose of this work is to parmeterize wind variability for use in diffusion estimates and modeling. For what types of diffusion conditions are the results we have obtained applicable? First, note that no detrending has been applied when determining the standard deviations reported here. This means that a given averaging time's results contain scales of motion larger than $L = U\,T_{ave}$ and a fraction of the variance is due to motions that would not be considered to be turbulence. This is of no consequence if one is interested in the total spread of a plume during the averaging time, including center of mass movement. If one is attempting to predict puff dispersion (relative diffusion) then inclusion of large scales of motion can lead to incorrect results.

Whether these results can be applied to puff dispersion or not can be determined from Table 14, or by examining the curves in Figures 30. At U = 5 m/sec, the 1 min average and 30 min average standard deviations are about 2 deg and 5 deg, respectively. If we assume that a slow turning of the wind (meander) is responsible for the variability, the ratio of the standard deviations would be the ratio of the averaging times.

This would lead to a 1 min standard deviation of about 0.1 deg, scaling to the 30 min average. Thus, the large 1 min standard deviation can be ascribed to turbulence and will result in relative diffusion for puff sizes of the order of L = (5 m/sec) x (60 sec) = 300 m. This conclusion is only approximate without looking at spectra, but does give us confidence that the results can be used for both puff and plume dispersion.

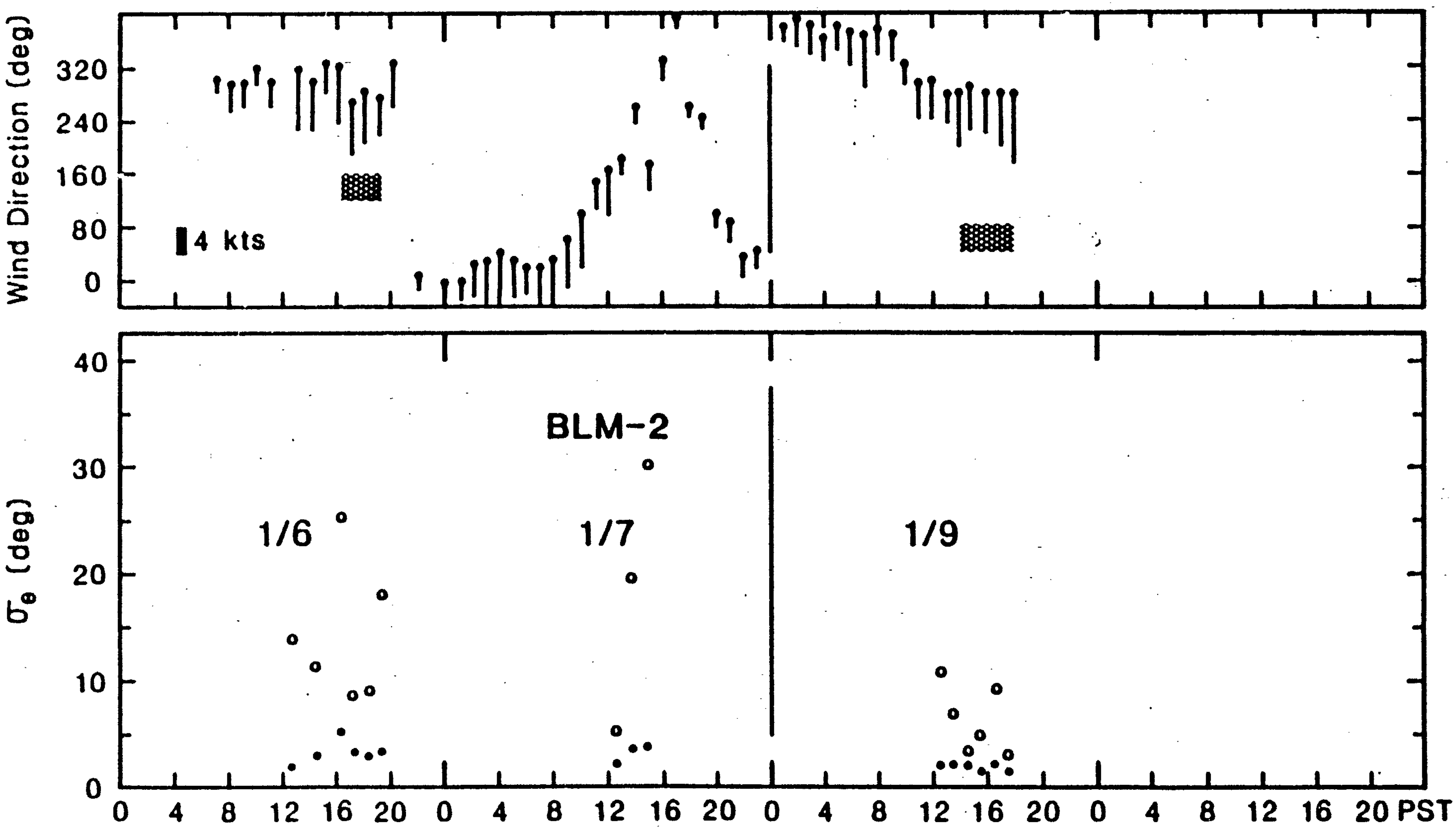
When using the results of this report to parameterize wind variability one must first determine if the situation is stationary. In this context, stationary means that there is a well established wind, that one is not in a land-sea-breeze transition period. If it is stationary, $C_{ms} = 0$ and if non-stationary the full Equation 23 or 20 is used to calculate the appropriate σ^2.

We do not expect these results to apply far from a coastline. In that case we expect $C_{ms} = 0$, however, we recommend that at-sea data be collected to verify this opinion so that a universal parameterization can be confirmed.

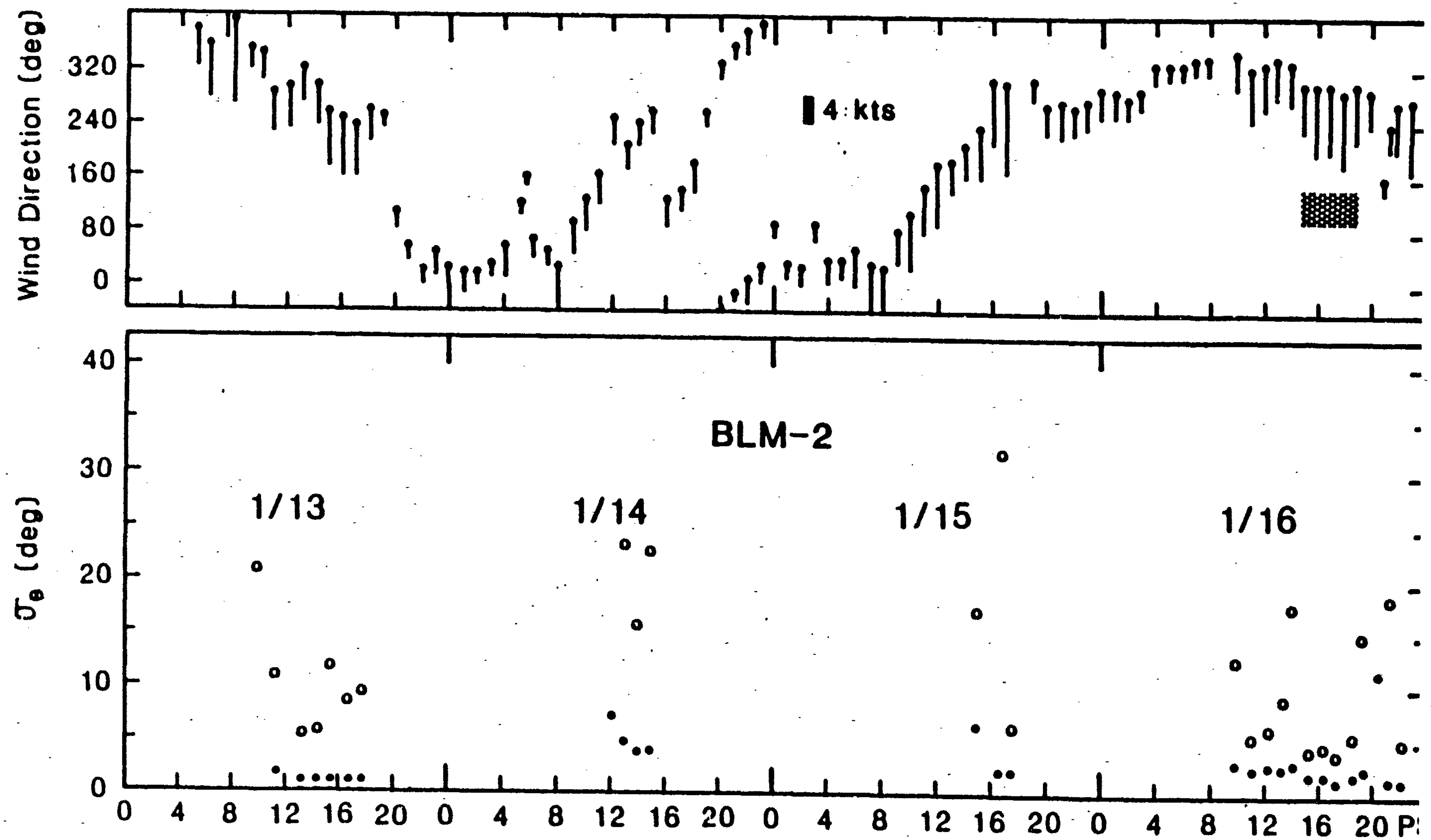
Appendix A

WIND TIME SERIES

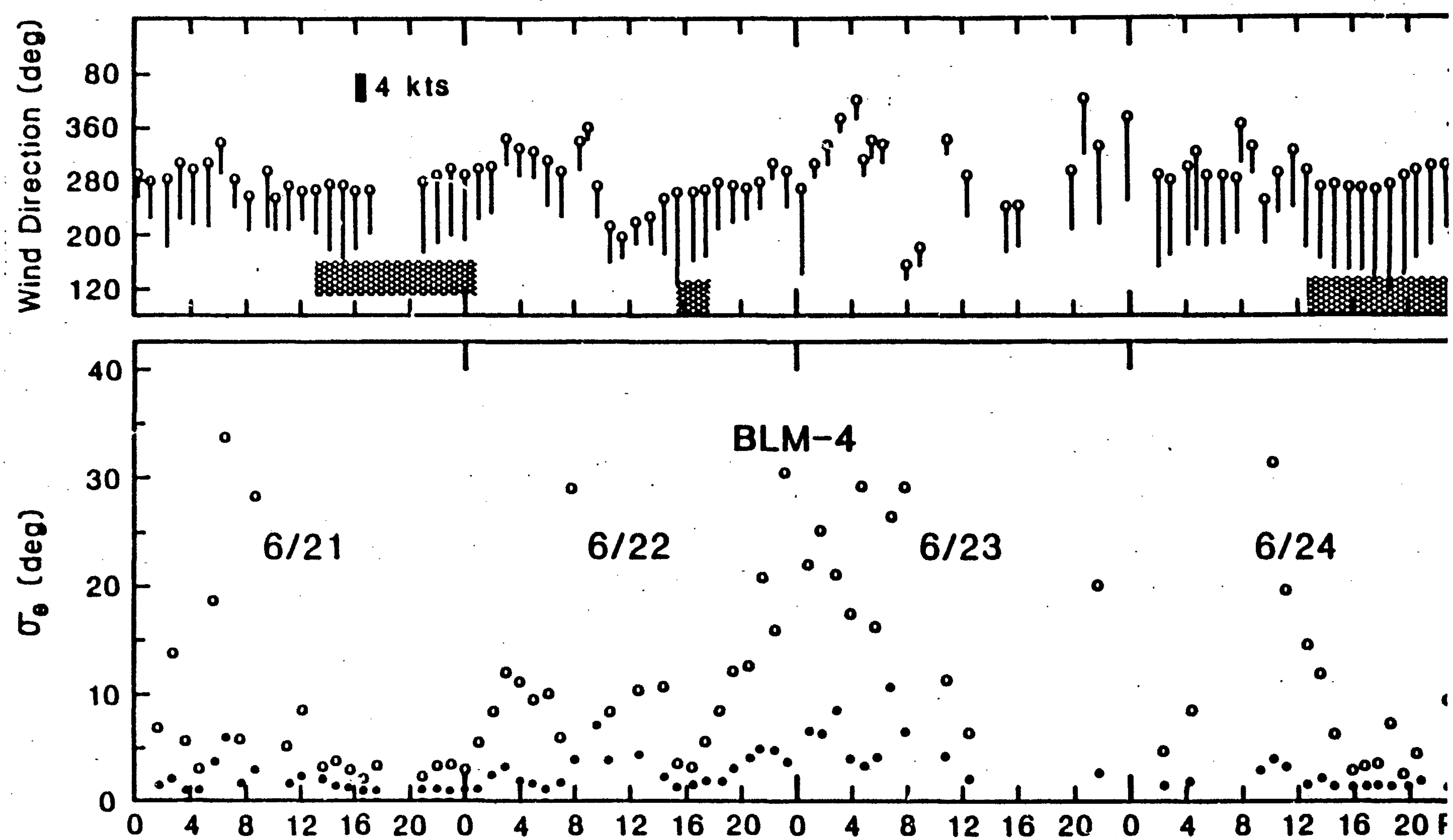
The following graphs are time series of the wind directions, wind speeds, and wind direction standard deviations. In the upper graphs, the dots are the wind direction and the length of the bars attached to the dots show the wind speed. In the lower graphs, the open circles are the one-hour average wind direction standard deviations, the dots the one-hour average of all 1 min average standard deviations that occured during that period.



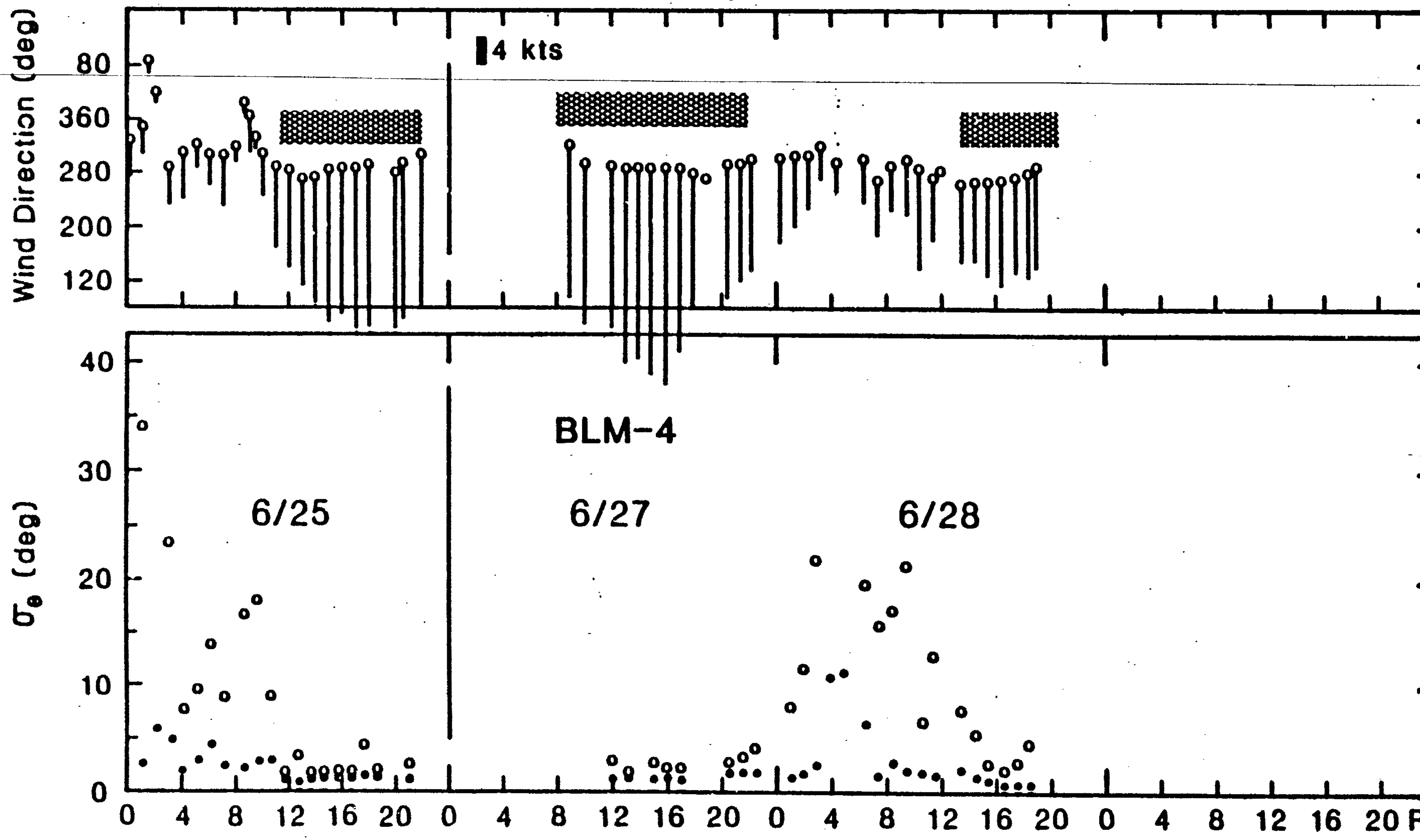
Wind Direction (deg)
320
240
160
80
0
4 kts
BLM-2
σθ (deg)
40
30
20
10
0
1/6
1/7
1/9
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 PST



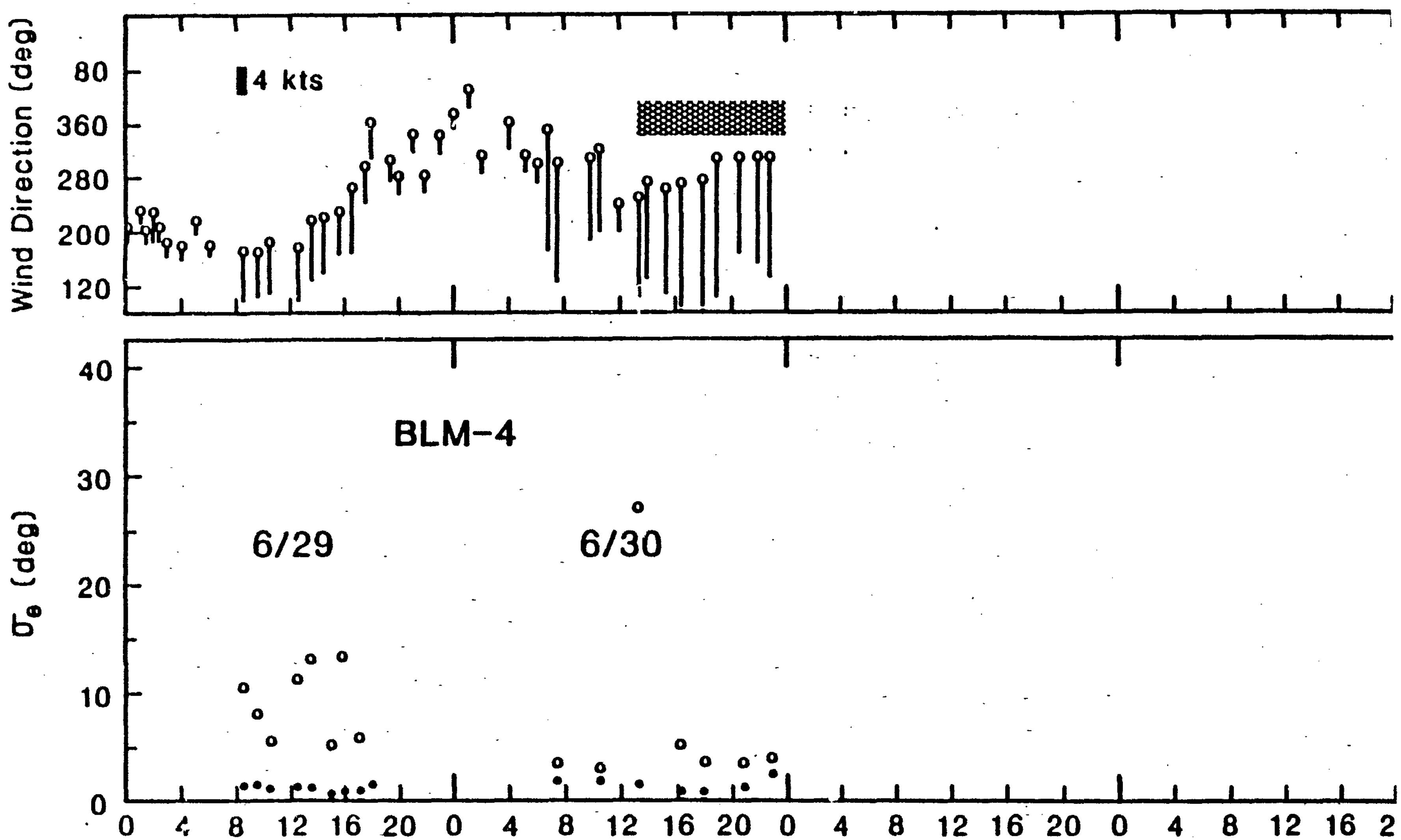
Wind Direction (deg)
320
240
160
80
0
4 kts
40
30
20
10
0
σ_θ (deg)
BLM-2
1/13
1/14
1/15
1/16
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 P



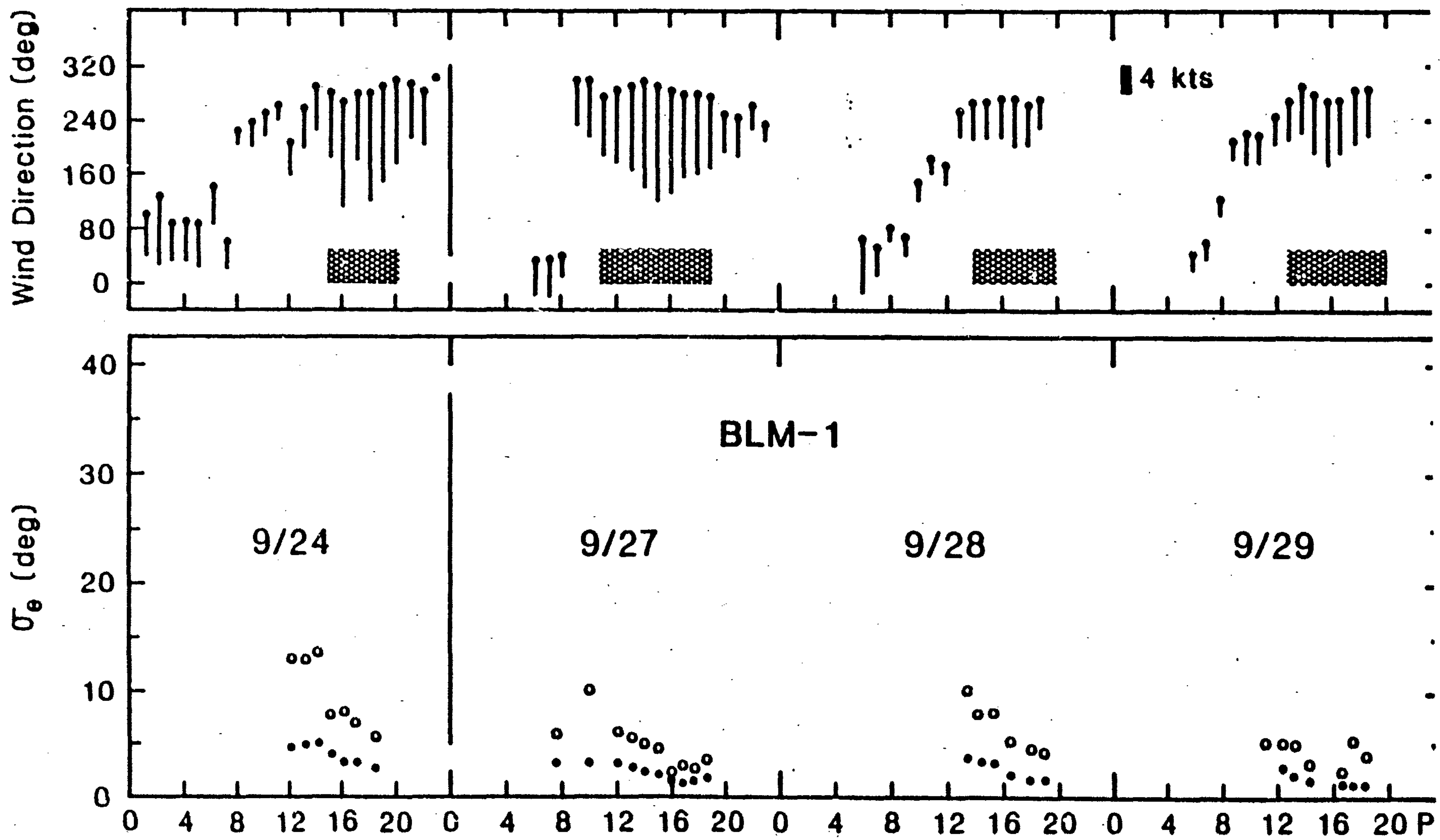
Wind Direction (deg)
80
360
280
200
120
4 kts
40
30
20
10
0
σ_θ (deg)
BLM-4
6/21
6/22
6/23
6/24
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20

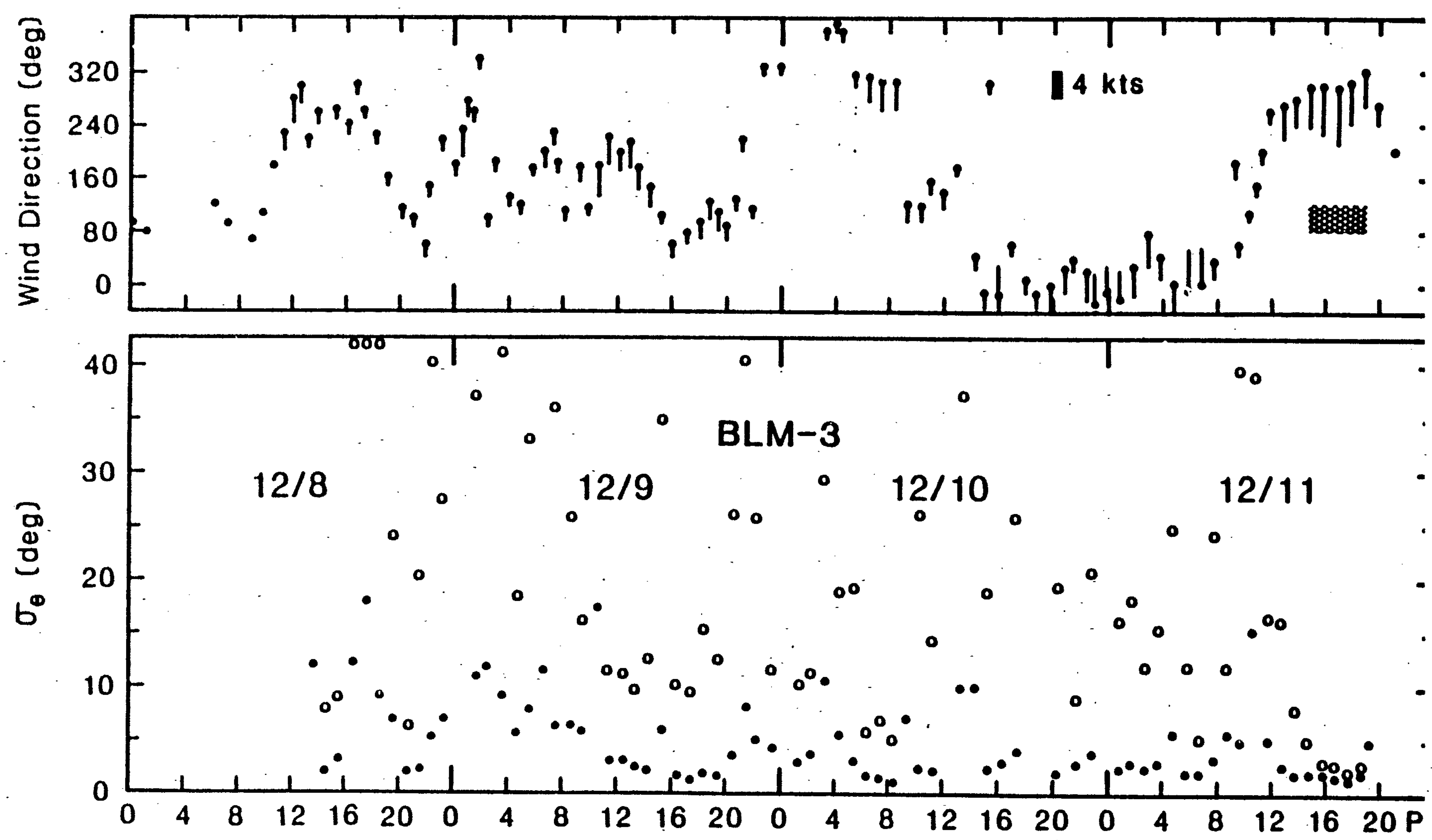


Wind Direction (deg)
80
360
280
200
120
4 kts
BLM-4
6/25
6/27
6/28
σ_θ (deg)
40
30
20
10
0
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 P

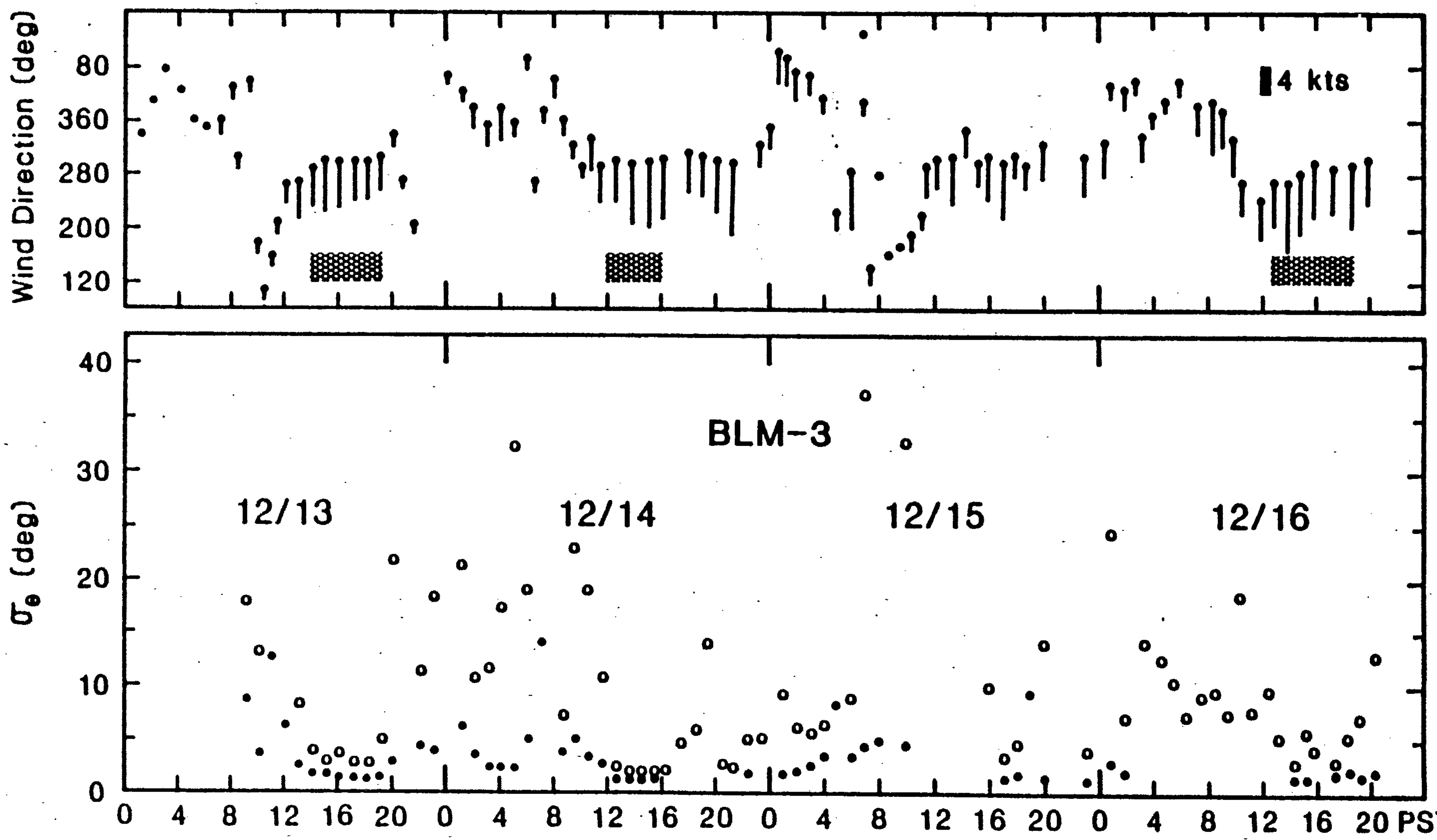


Wind Direction (deg)
80
360
280
200
120
4 kts
BLM-4
σ_θ (deg)
40
30
20
10
0
6/29
6/30
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 2

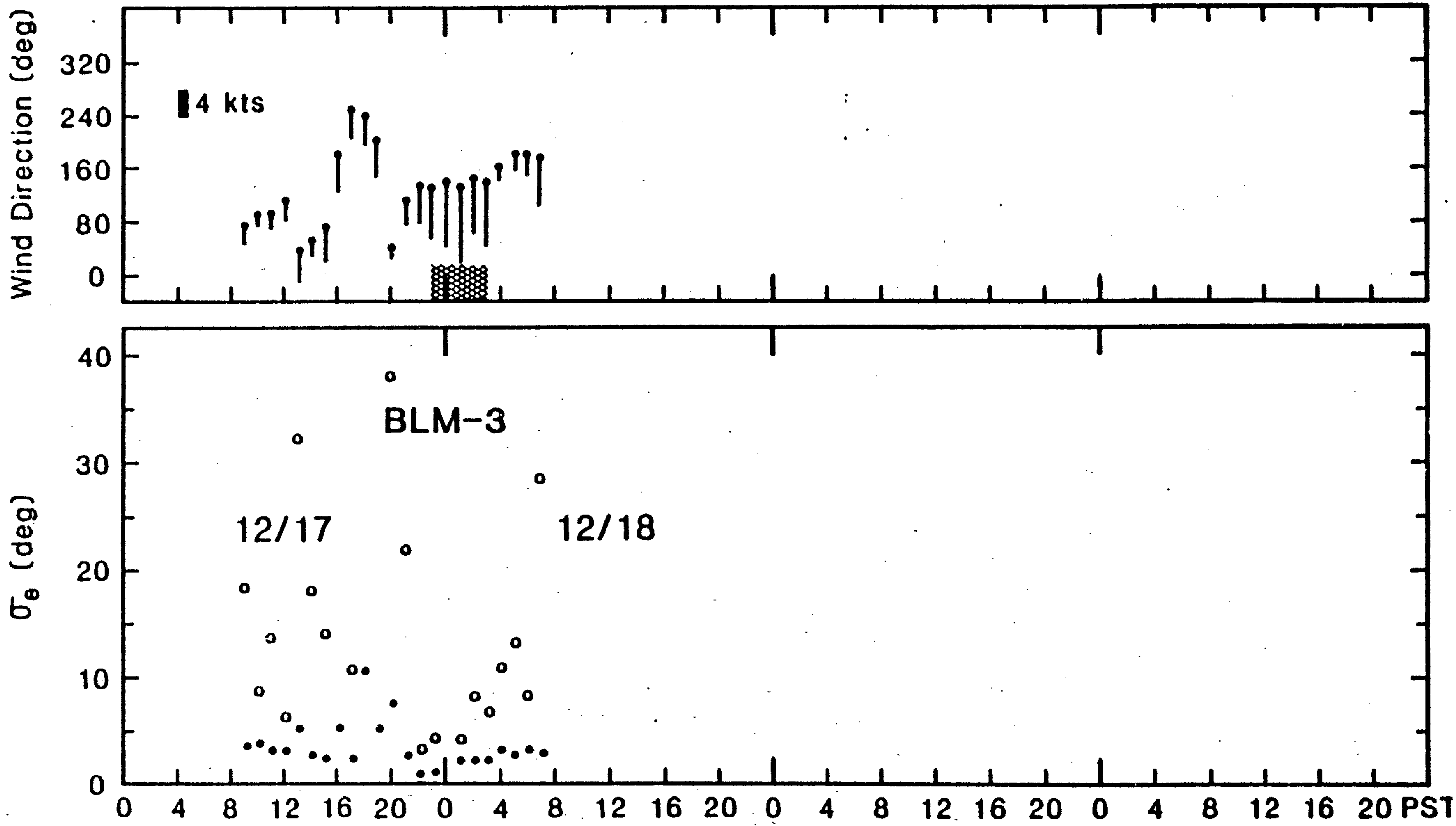

Wind Direction (deg)
320
240
160
80
0
4 kts
σθ (deg)
40
30
20
10
0
BLM-1
9/24
9/27
9/28
9/29
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 P



Wind Direction (deg)
320
240
160
80
0
4 kts
σθ (deg)
40
30
20
10
0
BLM-3
12/8
12/9
12/10
12/11
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 P



Wind Direction (deg)
80
360
280
200
120
4 kts
σθ (deg)
40
30
20
10
0
BLM-3
12/13
12/14
12/15
12/16
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 PST


Wind Direction (deg)
320
240
160
80
0
4 kts
σ_θ (deg)
40
30
20
10
0
BLM-3
12/17
12/18
0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 0 4 8 12 16 20 PST

Appendix B

CROSS WIND SPEED FLUCTUATIONS, REGULATORY CONSIDERATIONS

This appendix follows correspondence from Steve Hanna to Walter Dabbert, where he originally presented many of the thoughts contained here. This appendix is included so that these considerations will be contained with the data used and compared to modeling we have done.

The cross wind speed fluctuations can be found directly from the wind direction fluctuations from

$$\tan \sigma_v = U \sigma_\theta .$$

The centerline concentration of a plume (Gaussian model) depends inversely on σ and a function of the downwind distance. Thus, this parameter is of central importance in determining impact of a pollutant cloud.

In the absence of measuring σ directly, regulations specify methods for its estimation. Clearly, estimating a small σ predicts a high concentration and large impact. Worst case will be for low wind speed stable conditions. Common practice is to estimate, for stable conditions, that

$$\sigma_\theta = 2.5 \text{ deg and } U = 1 \text{ m/sec},$$

from which one has, upon converting σ to radians,

$$\sigma_v \cong 0.04 \text{ m/sec}.$$

This is a very low value, and it is instructive to compare it to the results contained in this report.

Our parameterization for σ can be written as

$$(U\sigma_\theta)^2 = C_w k^{2/3} w_*^2 + C_U U_*^2 + C_{ms}.$$

From this and the results for the parameters contained in the body of this report it is a simple matter to compute values of $U\sigma$ for various conditions. Such results are contained in Table B-1 for stable conditions ($w_*=0$).

Of course, there is also considerable interest in the worst case senario, which occurs for the minimum value of $U\sigma$. We show the σ vs. U data, as log-log plots in Figures B-1. On the plots the straight line shows the minimum value of $U\sigma$ observed. These minima are also listed in Table B-1.

$U\sigma_\theta$ (m/sec)

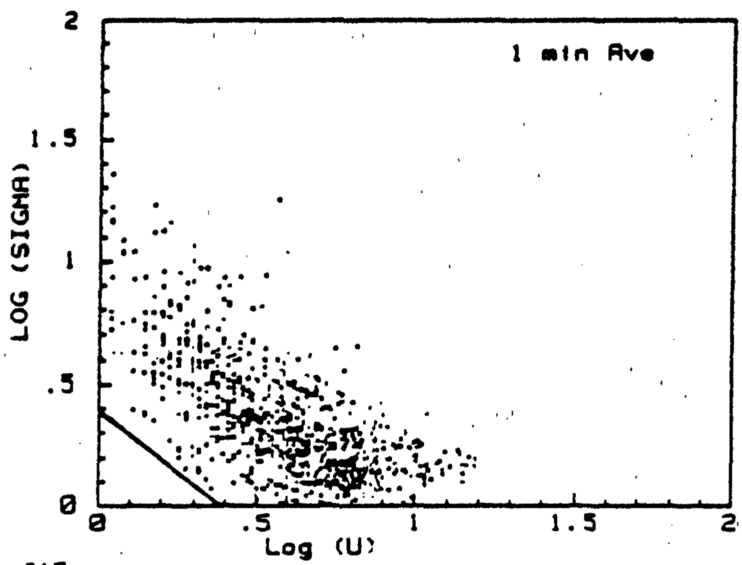
Tave	U =	Model Prediction 1m/sec	10m/sec	Mimimum Observed Stationary	All Cond.
1min		0.14	0.29	.06	.04
3min		0.25	0.38	.07	.07
10min		0.35	0.48	.06	.06
30min		0.50	0.65	.15	.09
60min		0.71	0.84	.17	.15

Table B-1. Model predicted and minimum observed cross wind speed standard deviations.

Table B-1 shows that the observed worst case scenarios are far "less worst" than that recommended for used by the regulatory agencies. For one-hour average impact from a plume, Figures B-1 show that a sensible worst case scenario would be:

$$U\sigma_\theta(60\text{min, worst case}) = 0.2 \text{ m/sec.}$$

The factor of at least 4 difference in the accepted and observed worst case scenarios is significant. The reason for the difference is undoubtedly the fact that the low value currently used was determined during very stable, overland conditions. Such conditions do not occur overwater. Of course, a factor of 4 underestimate of σ_y translates into a factor of 4 over estimate of plume concentration.



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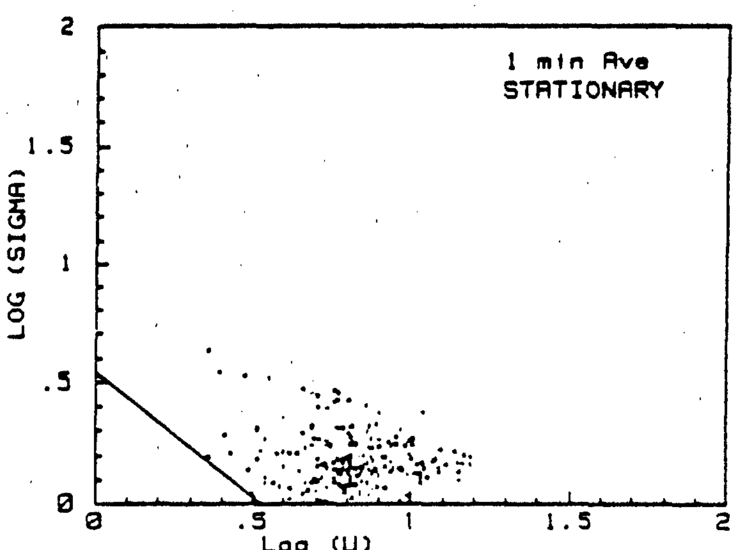

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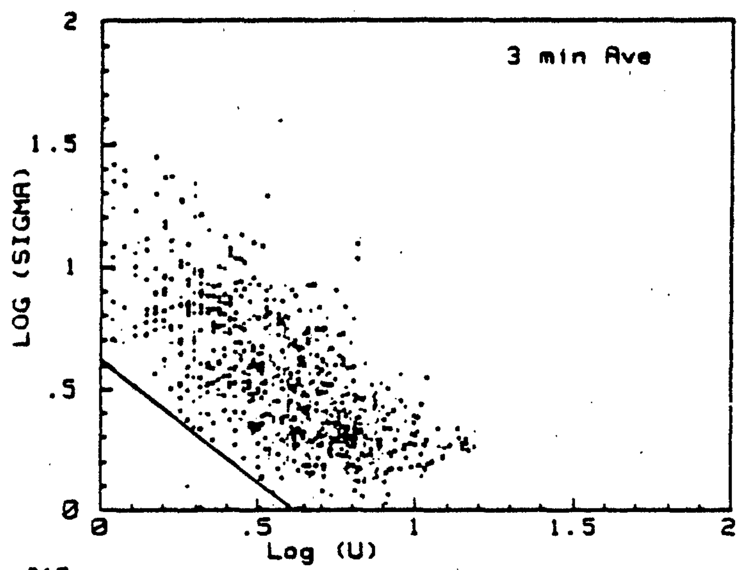
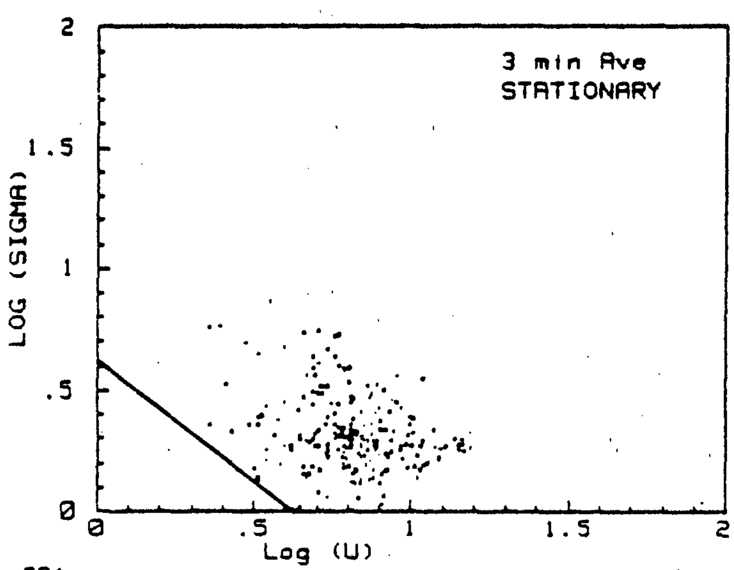
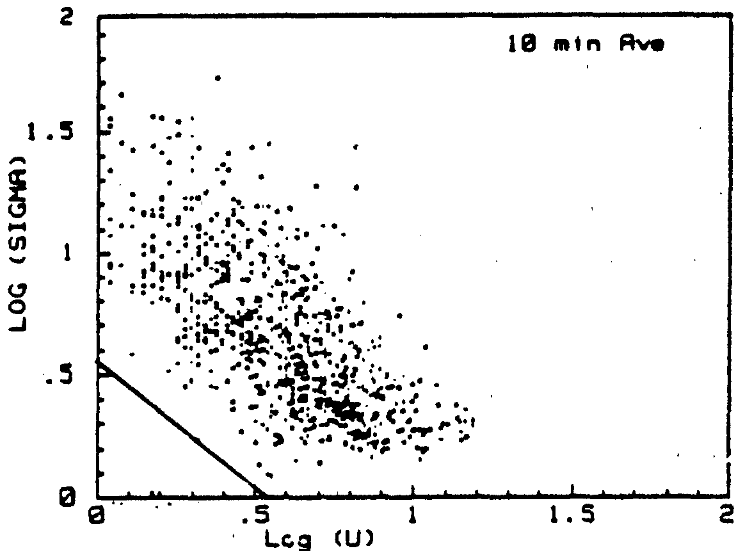

3 min Ave
LOG (SIGMA)
2
1.5
1
.5
0
0
.5
1
1.5
2
Log (U)

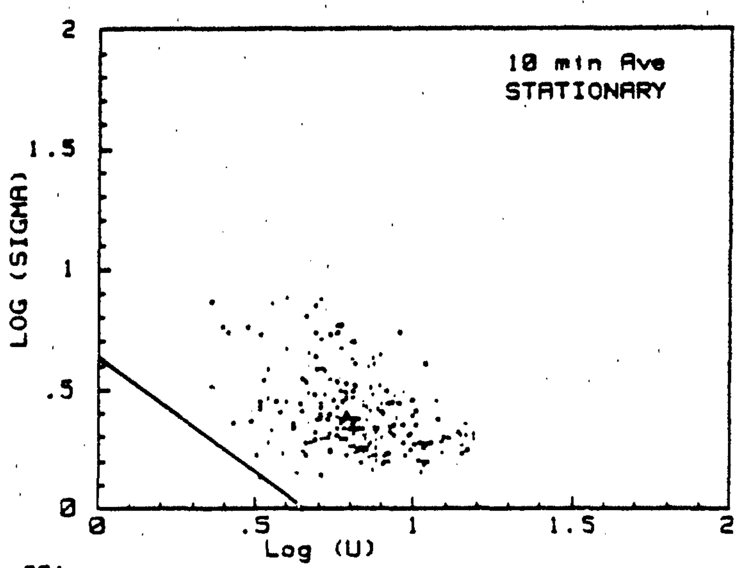
815


3 min Ave
STATIONARY
LOG (SIGMA)
2
1.5
1
.5
0
0
.5
1
1.5
2
Log (U)

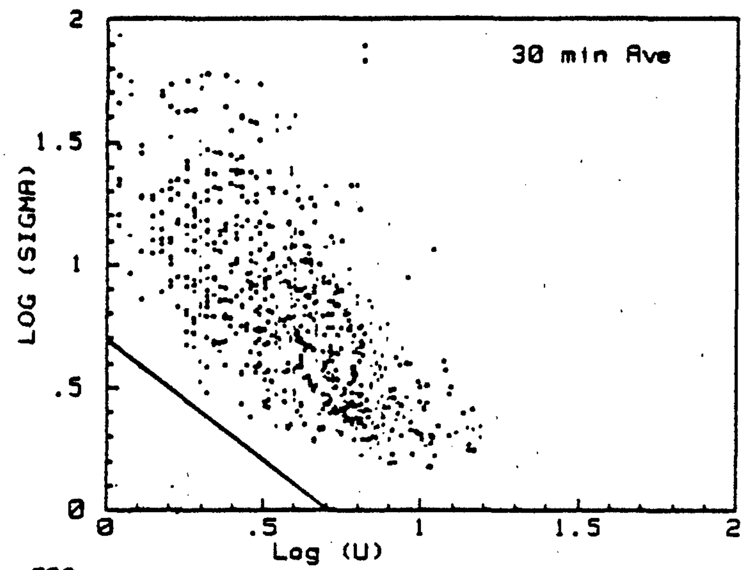
221


10 min Ave
LOG (SIGMA)
Log (U)
2
1.5
1
.5
0
0
.5
1
1.5
2

813

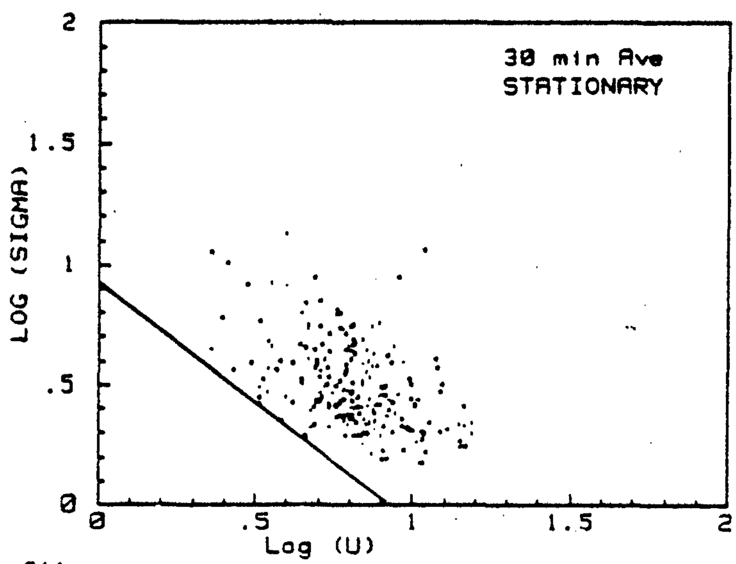

10 min Ave
STATIONARY
LOG (SIGMA)
Log (U)
2
1.5
1
.5
0
0
.5
1
1.5
2

221



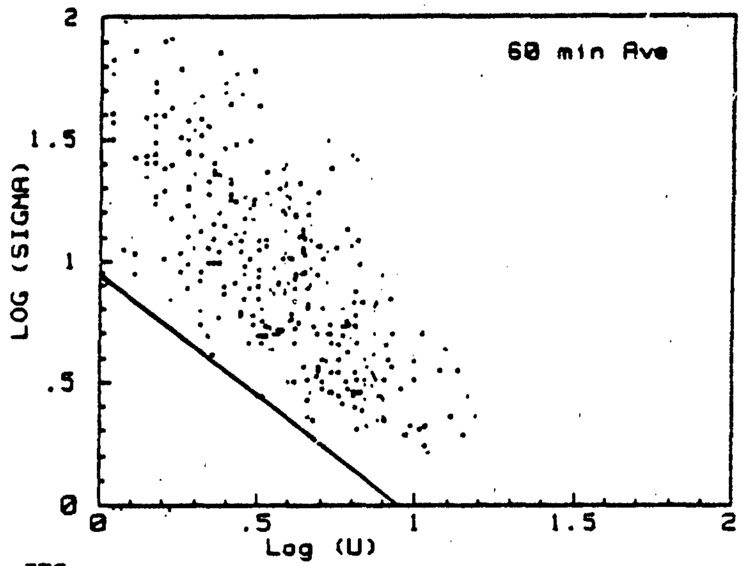
30 min Ave
LOG (SIGMA)
Log (U)

728

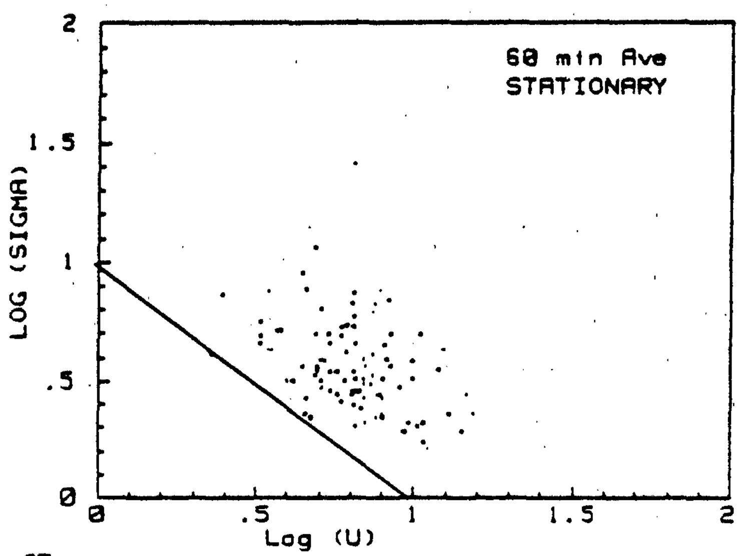


30 min Ave
STATIONARY
LOG (SIGMA)
Log (U)

211


60 min Ave
LOG (SIGMA)
Log (U)
2
1.5
1
.5
0
0
.5
1
1.5
2

332


60 min Ave
STATIONARY
LOG (SIGMA)
Log (U)
2
1.5
1
.5
0
0
.5
1
1.5
2

97

Appendix C

METEOROLOGICAL DATA AND HALF-HOUR σ_θ

The following tables list half hour average meteorological data and the half hour averages of the average σ_θ over 4 averaging times, and the 60 m average. Data is averaged over the half hour preceeding the time indicated. The following are the data included:

Code	1 = non-stationary, 2 = stationary,
Z_i	inversion height (m)
Rel	wind direction relative to ship bow (deg)
WD	true wind direction (deg)
10/L	10 m divided by Monin-Obukhov length
U	true wind speed (m/sec)
U_*	friction velocity (m/sec)
w_*	convective mixing velocity (m/sec)
σ_θ	horizontal wind direction standard deviation (deg)

BLM-1 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
9/23													
1642	1	310	357	258	-.425	4.6	.156	.525	3.5	5.9	8.1	8.5	
1717	1	260	353	257	-.507	4.8	.165	.554	3.0	8.8	9.4	10.4	
1749	1	260	354	258	-.629	4.7	.162	.585	4.3	6.9	6.9	9.1	9.8
9/24													
1137	1	330	55	238	-2.381	2.1	.073	.444	4.6	7.9	10.2	10.3	
1205	1	360	209	42	-2.554	2.1	.073	.469	5.1	8.4	13.5	12.9	13.2
1233	1	350	36	236	-2.782	2.0	.068	.442	4.7	6.8	9.9	10.1	
1301	1	350	18	227	-1.911	2.3	.078	.448	3.7	6.2	12.0	13.9	12.9
1329	1	340	25	246	-2.967	1.9	.065	.430	5.1	7.1	9.4	9.0	
1357	1	330	17	260	-1.666	2.8	.093	.503	4.2	9.1	10.3	9.6	11.5
1425	1	300	4	263	-.746	3.9	.131	.526	3.6	5.8	7.1	7.9	
1453	1	280	358	261	-.687	3.9	.133	.506	4.0	5.7	6.9	7.6	7.7
1521	2	260	345	255	-.854	3.6	.123	.490	3.4	7.7	7.6	8.8	
1549	2	240	339	253	-.513	4.6	.156	.513	3.1	5.7	6.6	7.3	8.1
1617	2	250	342	259	-.275	5.9	.206	.557	3.0	5.6	6.1	6.6	
1645	2	260	342	266	-.209	6.4	.225	.562	2.8	4.1	5.2	5.8	7.0
1713	2	270	348	267	-.279	5.8	.200	.558	2.8	5.5	6.1	6.6	
1809	1	290	349	276	-.053	7.0	.243	.392	2.3	4.2	6.4	7.0	
9/27													
743	1	280	64	45	-2.514	2.8	.096	.562	3.5	4.6	5.9	5.7	6.2
859	1	340	282	289	-1.712	2.9	.098	.540	5.2	8.5	8.1	8.7	
945	1	200	276	270	-.561	4.6	.156	.496	3.0	5.1	5.7	6.2	
1013	1	200	283	287	-.744	3.9	.132	.460	2.8	3.8	4.5	5.1	10.2
1041	1	230	281	285	-.641	4.1	.138	.481	2.5	2.9	4.2	5.4	
1138	2	230	23	271	-.371	5.1	.175	.509	2.9	5.8	7.9	7.4	
1206	2	220	21	271	-.420	5.1	.176	.523	2.6	4.3	5.4	5.8	6.7
1234	2	200	17	276	-.335	5.5	.190	.508	2.6	4.8	5.6	5.4	
1302	2	220	11	275	-.274	5.9	.207	.535	2.8	4.2	4.9	5.7	5.6
1330	2	210	3	273	-.204	6.4	.226	.521	2.0	3.6	4.4	4.6	
1358	2	200	1	274	-.180	6.6	.229	.499	1.9	2.5	3.4	4.9	4.8
1426	2	200	356	272	-.119	7.6	.270	.512	1.9	3.2	4.2	4.5	
1454	2	130	355	274	-.088	8.3	.298	.444	1.6	3.3	3.3	3.3	4.1
1522	2	120	351	275	-.062	8.9	.337	.433	1.5	2.2	2.5	2.5	
1550	2	110	351	276	-.071	8.0	.284	.372	1.2	1.8	2.1	2.0	2.4
1618	2	110	351	273	-.064	7.8	.274	.348	1.5	2.7	2.7	2.8	
1646	2	110	347	274	-.059	7.9	.277	.341	1.2	2.0	2.7	3.0	2.9
1714	2	110	342	269	-.074	7.4	.257	.341	1.3	2.0	2.7	2.9	
1742	2	140	342	269	-.072	8.0	.282	.402	1.4	2.3	2.7	2.7	2.8
1810	2	140	344	270	-.101	7.0	.243	.387	1.5	2.7	3.0	4.1	
1838	2	160	340	268	-.147	5.8	.200	.378	1.6	2.7	2.8	2.8	3.6
1906	2	160	343	271	-.158	5.6	.192	.372	1.8	2.9	3.0	3.1	
9/28													
1307	1	210	25	235	-1.774	2.0	.067	.320	3.7	5.7	8.2	11.4	
1335	1	200	15	230	-1.429	2.3	.076	.331	3.4	5.7	6.9	8.5	10.3
1408	1	160	14	246	-.935	2.9	.094	.328	2.2	3.9	4.7	7.6	
1436	2	140	21	253	-1.744	2.5	.084	.347	3.6	6.1	6.0	6.3	7.7
1504	2	120	11	256	-1.080	3.0	.100	.333	3.5	5.2	6.0	8.7	
1532	2	120	7	263	-.741	3.5	.116	.342	1.9	2.8	4.0	5.1	7.9

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1600	2	120	352	258	-.672	3.4	.111	.317	1.7	2.6	3.6	3.5	
1628	2	140	347	255	-.532	3.3	.106	.295	2.2	4.7	5.6	6.1	5.1
1740	2	120	342	266	-.582	3.1	.102	.277	1.4	2.4	2.4	4.1	
1808	2	110	335	261	-.486	3.5	.114	.283	1.3	1.7	2.0	3.9	4.5
1836	2	110	332	259	-.808	2.7	.088	.259	1.7	2.2	2.4	3.8	
1904	2	110	325	257	-1.147	2.3	.075	.248	1.6	2.4	3.4	4.7	4.3
9/29													
1217	1	100	32	232	-2.195	2.4	.079	.316	2.7	4.3	4.2	5.1	
1245	1	100	35	234	-1.759	2.2	.072	.266	2.6	3.5	4.6	4.9	5.1
1347	2	90	33	258	-.485	3.3	.106	.247	1.6	2.6	2.8	2.7	4.8
1415	2	80	32	266	-.427	3.5	.114	.243	1.3	1.9	3.0	3.1	
1443	2	80	28	263	-.285	4.0	.129	.243	1.5	2.0	3.0	3.0	3.3
1511	2	70	21	264	-.096	4.7	.154	.193	1.3	2.0	3.2	4.2	
1540	2	60	6	262	-.023	5.5	.179	.134	1.5	2.0	2.2		
1626	2	60	344	268	-.053	4.8	.154	.155	1.2	2.6	2.0	2.6	
1654	2	50	333	267	-.052	4.6	.149	.137	1.1	1.5	1.8	2.0	2.4
1722	2	50	327	266	-.077	4.9	.162	.168	.9	1.6	2.0	2.3	
1750	2	40	326	274	-.079	5.4	.180	.175	1.1	1.8	2.1	3.9	5.2
1818	2	40	331	285	-.086	5.1	.169	.169	.9	1.3	2.5	3.6	
1846	2	30	328	288	-.120	4.5	.146	.149	.9	1.1	1.8	3.5	3.8
1902	2	30	322	287	-.113	4.3	.137	.136	1.0	1.1	1.5		

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1/05													
904	1	-1	191	116	.100	2.3	.064		6.9	9.4	12.0	20.9	
1/06													
1155	1	30	214	283	.027	6.1	.200		3.2	6.0	100.0		
1225	1	30	233	289	.028	6.1	.200		1.2	2.3	2.5	5.1	14.0
1355	1	30	5	298	.074	5.6	.175		1.9	4.2	6.7	13.2	
1425	1	30	3	296	.098	5.3	.163		3.3	5.5	5.8	9.4	11.5
1455	1	30	12	305	.265	4.3	.118		2.9	4.7	5.6	7.8	
1542	1	30	342	280	.739	2.6	.057		7.1	12.2	26.8	25.6	
1612	1	30	8	313	.205	5.4	.157		2.7	4.9	5.9	8.5	
1642	1	30	350	291	.235	4.7	.132		2.7	4.7	4.7	6.7	
1712	1	30	344	282	.140	5.3	.159		2.7	6.5	5.6	7.4	8.5
1742	1	30	341	277	.224	4.5	.128		2.5	5.6	8.4	10.9	
1812	1	30	343	274	.272	4.9	.137		2.3	4.1	3.7	6.4	9.1
1842	1	30	354	288	.265	3.7	.101		2.6	6.1	11.2	20.7	
1912	1	30	356	294	.474	2.7	.066		3.2	6.7	11.1	15.0	18.3
1942	1	30	77	29	-.762	1.6	.053	.100	5.2	9.5	14.9	21.3	
1/07													
1202	1	50	25	161	-.304	4.7	.160	.262	1.5	2.8	4.4	5.4	
1232	1	100	67	157	-.476	3.2	.104	.249	1.8	2.4	2.5	3.8	5.1
1320	1	100	83	208	-1.193	1.8	.058	.191	3.1	4.7	7.5	14.0	
1350	1	100	81	235	-1.345	1.5	.052	.176	3.7	6.8	12.3	13.5	19.4
1420	1	100	57	219	-.927	1.6	.052	.155	3.2	4.4	7.3	13.4	
1450	1	100	200	345	-1.275	1.5	.050	.167	3.9	8.1	14.3	0.0	29.9
1/09													
1149	1	100	276	276	-.550	3.7	.122	.305	2.3	4.0	10.0	12.3	
1221	1	100	352	282	-.394	4.1	.134	.301	1.7	3.8	4.8	7.5	10.7
1309	1	100	340	278	-.342	4.1	.137	.293	2.1	3.4	3.6	4.0	
1339	1	100	348	270	-.253	4.6	.154	.299	1.7	2.8	4.6	6.3	6.7
1409	1	100	352	283	-.230	4.7	.156	.292	1.9	2.9	2.9	3.4	
1439	1	100	353	281	-.213	4.6	.153	.279	1.8	2.5	3.1	3.3	3.4
1509	1	100	351	282	-.145	5.0	.166	.268	1.4	1.7	2.6	5.4	
1539	1	100	348	277	-.179	4.2	.136	.235	1.4	2.1	2.0	2.5	4.8
1609	1	100	347	274	-.243	3.2	.101	.193	1.8	3.2	3.3	4.9	
1639	1	100	347	279	-.210	2.9	.091	.167	2.5	5.8	6.7	11.6	9.2
1709	1	100	338	273	-.107	4.1	.131	.191	1.5	2.2	2.5	2.7	
1739	1	100	338	272	-.092	4.7	.154	.214	1.4	1.7	2.3	3.4	3.0
1809	1	100	345	278	-.073	5.2	.170	.217	1.7	2.7	3.0	4.4	
1/13													
852	1	30	73	27	-.314	3.9	.129	.180	2.6	8.7	10.2	12.8	
948	1	30	74	356	-.106	3.0	.090	.089	1.7	3.4	5.8	15.0	
1049	1	30	243	302	.086	3.3	.096		2.0	4.0	4.1	11.1	
1119	1	30	236	296	.003	4.5	.141		1.7	4.1	7.0	10.6	11.1
1239	1	30	345	294	.048	4.9	.152		1.4	2.7	2.9	3.1	
1309	1	40	348	304	.034	5.4	.172		1.4	1.9	2.6	2.6	5.7
1339	1	40	346	290	.065	5.3	.167		1.3	2.1	3.9	6.6	
1409	1	40	350	285	.088	6.1	.194		1.1	2.1	2.2	3.9	5.9
1439	1	40	346	282	.110	5.5	.171		1.3	2.1	2.6	5.5	
1509	1	50	349	262	.080	5.6	.176		1.3	2.7	3.0	5.8	11.8

BLM-2 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1521	1	50	356	261	.081	5.1	.157		1.1	2.0	4.6		
1559	1	50	346	253	.056	5.4	.169		1.3	3.9	5.1	7.0	
1629	1	50	338	242	.057	4.0	.120		1.4	3.4	3.6	5.8	8.5
1659	1	50	336	239	.033	4.3	.132		1.4	4.1	5.6	10.6	
1729	1	50	349	241	.015	4.4	.137		1.6	2.2	2.6	7.7	9.3
1/14													
1130	1	130	343	171	-.100	3.1	.096	.152	2.0	4.2	5.9	15.7	
1200	1	100	271	108	-.262	2.0	.061	.121	12.0	22.8	31.7	0.0	46.4
1230	1	80	359	230	-.253	2.5	.075	.137	5.1	6.7	8.1	10.4	
1300	1	30	316	196	-.482	2.3	.072	.116	4.1	8.7	12.1	21.3	23.6
1330	1	70	269	190	-.633	1.8	.058	.137	4.0	5.1	6.4	6.6	
1400	1	100	282	199	-.576	1.7	.054	.138	3.5	5.8	8.4	20.3	15.7
1430	1	120	283	230	-.404	1.8	.057	.137	4.5	7.9	8.1	8.6	
1500	1	150	347	262	-.234	2.6	.079	.171	3.4	7.8	8.9	22.0	22.7
1/15													
1441	1	150	11	194	-.423	3.3	.106	.279	2.3	5.0	4.7	15.1	
1500	1	200	19	220	-.190	4.8	.160	.355	2.0	3.5	4.0		
1552	1	200	55	271	-.187	4.0	.128	.284	2.2	6.4	11.9		
1622	1	200	49	294	-.132	5.3	.176	.346	1.9	2.7	4.1	5.8	
1652	1	200	29	294	-.096	6.2	.210	.370	2.0	3.2	3.5	3.6	
1722	1	200	46	285	-.102	5.9	.201	.362	2.1	4.4	4.5	6.2	6.6
1/16													
938	1	390	346	355	-.814	2.8	.092	.415	.1	.2	.4	.6	
1008	1	380	335	335	-.843	2.8	.089	.404	2.4	5.9	5.3	9.0	12.7
1050	1	380	354	322	-.340	4.0	.130	.433	2.3	3.5	3.8	3.9	
1120	1	370	10	327	-.460	3.5	.113	.413	2.0	4.5	5.4	6.0	5.5
1156	1	360	13	333	-.561	3.3	.109	.420	2.4	4.0	4.5	5.0	
1220	1	380	16	341	-.701	3.1	.102	.434	3.0	4.3	4.4	4.6	6.2
1250	1	380	9	339	-.791	3.1	.101	.446	2.5	4.3	4.8	6.6	
1320	1	360	360	331	-.710	3.2	.104	.436	2.4	4.2	6.8	9.1	8.9
1350	1	340	1	332	-.922	2.8	.092	.412	.1	.1	.3	.5	
1420	1	320	342	307	-.733	3.1	.101	.409	2.8	5.0	5.6	6.5	17.8
1520	2	330	346	298	-.170	5.3	.179	.452	1.5	3.4	4.0	4.2	
1550	2	320	345	295	-.176	5.1	.172	.434	1.5	3.2	2.8	3.5	4.1
1620	2	320	346	296	-.146	5.2	.175	.416	1.9	3.4	4.1	4.8	
1650	2	310	348	298	-.104	5.5	.186	.391	1.9	3.5	3.7	4.5	4.8
1720	2	310	343	293	-.094	5.8	.194	.395	1.4	2.4	2.1	3.3	
1750	2	300	342	288	-.117	5.3	.176	.381	1.3	3.2	3.2	3.3	4.0
1820	2	300	356	302	-.140	4.4	.141	.324	1.7	2.8	2.9	4.8	
1850	2	290	352	296	-.173	3.8	.122	.298	1.7	2.5	2.7	4.2	5.4
1920	1	290	0	303	-.226	3.3	.105	.280	2.7	4.2	6.3	6.7	
1950	1	280	340	276	-.591	2.3	.073	.265	2.0	4.0	5.0	5.1	14.9
2020	1	280	355	293	-3.804	.8	.032	.218	11.7	21.8	33.6		
2050	1	270	269	157	-2.035	1.3	.044	.239	6.0	10.4	13.5	19.7	76.2
2120	1	270	351	238	-.832	2.1	.069	.276	1.8	3.1	4.8	7.8	
2150	1	260	14	272	-.207	4.0	.127	.317	1.5	2.8	3.6	8.5	18.8
2220	1	260	8	283	-.103	5.3	.176	.347	1.3	2.4	2.8	4.5	
2250	1	250	13	289	-.053	6.3	.211	.331	1.3	2.5	2.9	3.8	5.0

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
12/05													
1448	1	333	31	319	-.203	4.5	.148	.397	1.9	2.2	2.4		
12/06													
1116	1	400	148	342	.015	6.1	.199		.9	1.7	2.8	4.9	
1146	1	420	163	325	0.000	5.8	0.000		1.5	1.8	2.1	2.6	6.8
12/07													
748	1	100	79	45	1.158	3.5	.070		3.0	6.8	11.2	36.8	
818	1	80	280	135	24.490	2.0	.005		4.0	9.7	17.7	18.9	35.7
848	1	80	240	64	0.000	1.4	0.000		2.5	6.2	8.8	13.3	
12/08													
1109	1	50	70	231	0.000	3.4	0.000		1.2	1.9	2.1		
1119	1	30	70	243	.600	3.8	.091		1.3	2.4	3.1		
1129	1	30	68	244	.876	3.6	.079		.9	1.1	1.3		
1139	1	30	22	244	5.975	2.4	.020		8.2	10.4	55.1		
1159	1	30	63	306	33.870	2.8	.005		8.9	14.0	16.8		
1209	1	30	72	331	5.118	2.5	.023		4.9	6.7	8.6		
1219	1	30	40	310	2.638	2.0	.028		4.2	10.0	23.1		
1252	1	30	343	226	104.100	1.0	.001		18.7	31.8	46.5	66.2	
1322	1	30	30	265	103.600	1.5	.001		4.0	5.7	7.7	8.0	51.7
1352	1	30	18	267	1.561	2.0	.035		1.8	2.9	3.1	7.2	
1422	1	30	10	263	6.840	1.9	.014		2.5	4.1	5.6	8.1	8.1
1452	1	30	17	271	200.400	.9	0.000		3.7	5.5	7.9	11.9	
1522	1	40	10	265	19.160	1.3	.004		2.6	3.4	4.0	4.0	9.3
1552	1	60	344	242	236.700	.8	0.000		9.8	21.9	29.9	40.5	
1622	1	80	24	302	0.000	1.1	0.000		15.1	18.1	23.0	31.3	42.0
1652	1	100	344	269	0.000	.8	0.000		8.3	10.3	12.0	16.9	
1722	1	130	10	292	0.000	.8	0.000		27.9	34.3	52.6	53.2	42.1
1752	1	130	308	226	0.000	.9	0.000		14.2	17.6	21.8	39.5	
1822	1	130	284	168	0.000	1.5	0.000		3.7	6.3	10.6	17.1	41.8
1852	1	130	279	132	0.000	1.3	0.000		11.5	17.8	27.6	31.9	
1922	1	130	315	116	1.855	2.0	.033		3.0	3.7	3.7	6.6	23.9
1952	1	130	338	115	-.021	2.1	.061	.064	2.4	3.4	5.7	7.0	
2022	1	130	350	109	-.303	2.8	.087	.197	1.7	2.5	3.6	4.1	6.4
2052	1	130	334	101	-.237	2.6	.079	.164	1.6	2.5	3.1	5.5	
2122	1	130	295	65	-.605	1.6	.053	.151	2.9	4.4	6.8	12.9	20.3
2152	1	80	354	146	-1.314	1.3	.046	.144	6.0	9.7	18.4	29.6	
2222	1	125	44	208	-1.071	2.1	.067	.227	4.6	6.8	12.3	21.1	40.2
2252	1	160	60	227	-2.232	1.9	.065	.305	4.8	7.4	9.2	16.5	
2322	1	180	22	181	-5.216	1.3	.047	.304	8.9	11.9	15.9	20.1	27.7
2352	1	200	20	180	-2.770	1.9	.067	.361	4.8	6.9	9.2	15.1	
12/09													
22	1	210	49	238	-.707	3.8	.128	.447	3.9	6.2	9.6	15.8	
52	1	220	48	272	-.917	3.4	.112	.434	3.9	8.4	8.4	11.3	
122	1	240	311	154	-4.400	1.5	.054	.365	17.6	29.4	37.9	50.9	37.1
152	1	220	163	356	-7.248	1.1	.044	.337	8.5	10.9	11.4	16.1	
222	1	220	266	105	-7.726	1.1	.043	.336	15.5	27.2	37.4	61.9	70.1
252	1	220	339	190	-5.417	1.4	.051	.360	8.9	12.3	15.3	16.5	
322	1	220	283	128	-3.965	1.6	.058	.368	9.5	15.1	27.1	34.5	41.2
352	1	220	292	132	-3.728	1.7	.060	.372	6.8	12.2	13.5	16.0	

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
422	1	250	290	110	-1.733	2.6	.087	.433	4.7	7.2	9.5	14.1	18.5
452	1	250	313	123	-3.840	1.8	.065	.424	6.6	11.1	13.9	27.8	
522	1	270	332	172	-8.891	1.1	.044	.387	9.0	11.4	12.4	15.2	32.9
552	1	300	342	192	-11.920	.9	.036	.367	13.6	16.5	22.4	30.7	
622	1	310	342	200	-2.721	2.1	.071	.441	9.8	17.1	28.1	62.9	49.7
652	1	350	17	234	-3.315	1.8	.062	.431	6.8	10.5	14.7	18.3	
722	1	330	345	186	-2.617	2.0	.069	.434	6.0	10.3	15.9	33.3	36.1
752	1	320	331	112	-3.215	1.9	.065	.433	5.8	10.7	12.0	13.1	
822	1	310	354	147	-4.025	1.7	.060	.427	7.2	13.3	20.3	23.4	26.0
852	1	330	7	171	-4.319	1.6	.059	.435	6.4	9.7	15.9	19.2	
922	1	360	8	175	-2.287	2.4	.081	.502	5.5	8.8	11.2	12.8	16.4
952	1	410	311	116	-17.760	.7	.031	.398	17.4	28.1	32.5	65.3	
1022	1	540	347	177	-3.414	1.7	.059	.480	14.9	24.4	31.1	43.8	85.3
1052	1	500	7	213	-.312	4.0	.130	.461	3.3	5.8	8.3	9.2	
1122	1	540	352	198	-.242	4.4	.146	.491	3.1	4.5	5.9	7.6	11.5
1152	1	580	355	197	-.509	3.1	.101	.445	3.0	4.4	5.9	9.4	
1222	1	600	359	203	-.278	3.9	.126	.460	3.7	6.5	8.6	12.3	11.3
1252	1	610	336	176	-.288	3.5	.113	.418	3.3	5.6	7.1	9.7	
1322	1	630	333	172	-.280	3.6	.116	.432	2.1	4.2	5.4	9.7	9.8
1352	1	650	327	162	-.313	3.5	.112	.435	2.3	4.3	5.5	7.1	
1422	1	620	319	142	-.304	3.4	.107	.405	2.1	3.5	4.6	7.8	12.8
1452	1	560	297	111	-.355	2.6	.081	.312	2.5	5.6	10.2	15.3	
1522	1	520	236	79	-2.364	.7	.025	.175	10.2	17.5	31.9	41.8	35.0
1552	1	470	225	61	-.174	1.5	.048	.141	2.3	3.8	6.5	11.8	
1622	1	430	260	68	.112	1.9	.054		1.5	3.3	5.1	6.1	10.1
1652	1	360	261	75	.324	2.1	.053		1.7	3.4	5.3	8.2	
1722	1	320	281	86	.088	3.2	.093		1.2	2.0	3.0	7.6	9.6
1752	1	250	327	101	-.012	5.3	.171	.167	1.5	2.7	3.0	4.2	
1822	1	230	336	129	-.037	2.9	.086	.121	2.6	3.5	4.3	8.3	15.6
1852	1	220	319	120	.002	2.4	.071		1.9	3.1	4.8	12.9	
1922	1	210	316	107	.231	3.2	.088		1.6	3.2	5.2	8.4	12.7
1952	1	200	290	84	-.018	2.2	.065	.073	1.4	2.6	4.4	6.5	
2022	1	190	322	128	.373	1.4	.037		5.8	7.0	8.7	19.1	26.3
2052	1	180	25	213	.582	.8	.020		13.7	17.3	23.8	38.9	
2122	1	170	85	281	-1.084	1.4	.047	.176	2.5	5.5	10.3	13.1	40.6
2152	1	170	278	115	-1.888	1.1	.038	.174	6.5	7.5	9.2	23.2	
2222	1	160	173	8	-2.680	1.0	.038	.189	4.0	5.0	7.0	9.2	25.8
2252	1	150	227	47	-.964	1.9	.062	.214	3.3	4.1	5.5	6.3	
2322	1	140	233	63	-2.130	1.2	.043	.188	5.8	7.2	9.4	9.6	11.6
2352	1	140	166	14	-3.774	.9	.035	.189	6.1	8.9	10.5	12.0	
12/10													
22	1	130	188	35	-2.497	1.2	.044	.197	5.1	6.9	9.1	14.4	
52	1	120	224	54	-1.061	2.0	.065	.217	3.2	4.4	4.2	4.3	
122	1	100	247	69	-.929	2.2	.072	.215	2.8	3.5	5.0	9.3	10.3
152	1	80	216	56	-1.366	1.8	.059	.187	4.5	5.6	7.1	14.8	
222	1	70	227	55	-.768	2.4	.076	.190	3.2	4.2	6.4	6.6	11.5
252	1	50	199	48	-2.435	1.3	.047	.153	15.3	17.5	20.3	27.1	
322	1	40	157	26	-1.937	1.4	.049	.139	6.2	8.7	11.7	28.3	29.3
352	1	30	172	39	-2.601	1.1	.039	.110	5.6	7.2	9.7	11.0	

BLM-3 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
422	1	30	155	26	-1.664	1.3	.046	.112	5.3	6.8	10.2	22.5	18.9
452	1	40	231	108	-.976	1.8	.059	.132	4.2	6.0	10.6	25.7	
522	1	60	73	313	-.231	2.2	.067	.107	2.5	4.2	6.6	9.1	19.5
552	1	90	70	311	-.038	3.2	.098	.099	1.8	3.3	4.1	5.7	
622	1	110	61	315	.032	4.1	.125		1.8	2.3	3.1	5.6	6.0
652	1	120	58	315	-.062	3.8	.118	.153	1.5	2.5	3.9	8.6	
722	1	150	48	311	.024	4.2	.128		1.6	2.2	2.9	4.3	7.1
752	1	170	41	309	.077	4.3	.129		1.3	2.9	3.4	5.0	
822	1	120	42	308	.057	3.6	.106		1.3	2.0	2.3	5.2	5.2
852	1	120	253	133	-1.592	2.0	.066	.251	8.6	16.9	37.3	55.1	
922	1	120	287	160	-1.702	2.5	.083	.321	6.0	10.2	24.1	36.6	51.5
952	1	120	325	279	-1.027	3.1	.102	.675	2.5	4.8	9.4	33.6	
1022	1	120	249	122	-1.550	2.3	.076	.579	2.2	3.5	4.1	7.5	26.2
1052	1	120	285	133	-1.391	2.2	.072	.531	2.6	3.5	5.2	12.1	
1122	1	120	53	155	-.879	2.5	.079	.500	1.7	2.7	4.5	6.0	14.5
1152	1	120	106	144	-.520	3.0	.096	.510	1.9	3.0	3.5	4.0	
1222	1	120	184	157	-2.064	1.2	.043	.360	5.5	6.2	6.5		
1252	1	120	178	173	-1.380	1.1	.039	.285	8.0	10.7	14.9	15.5	
1322	1	120	203	143	-.200	2.4	.072	.280	12.2	21.4	31.6	44.2	37.1
1352	L.	120	216	47	.086	1.4	.041		9.0	9.9	14.8	20.4	
1422	1	120	169	359	.338	1.0	.027		11.2	14.2	20.6	53.2	46.5
1452	1	0	107	298	.430	2.6	.064		2.3	3.5	5.0	7.8	
1522	1	0	122	327	.675	4.0	.095		2.4	4.0	6.2	14.6	18.9
1552	1	0	133	345	1.375	3.5	.066		1.8	2.6	4.5	5.6	
1622	1	0	246	71	74.850	1.7	.002		4.3	5.8	11.4	15.4	44.5
1652	1	0	214	47	0.000	1.1	0.000		6.3	10.4	16.4	22.7	
1722	1	0	77	6	.746	3.9	.091		2.1	4.5	6.6	24.6	25.9
1946	1	0	173	177	.367	3.9	.103		2.5	3.1	4.0	5.1	
2016	1	500	305	3	.434	3.9	.100		2.0	3.8	7.1	10.7	19.2
2046	1	500	340	29	.332	4.5	.123		2.3	4.1	4.8	9.8	
2130	1	450	327	46	.487	2.4	.056		2.7	4.2	6.2	8.4	
2200	1	400	302	40	.289	3.2	.085		3.5	6.5	6.5	8.8	9.0
2230	1	410	323	25	.211	4.4	.124		3.1	4.9	7.4	12.4	
2300	1	420	308	350	.211	3.7	.104		4.2	6.7	8.0	10.3	20.7
2330	1	430	9	338	.091	4.7	.144		2.2	3.0	4.1	7.4	
12/11													
0	1	440	60	354	.108	4.0	.117		1.7	2.6	4.7	8.3	
30	1	460	6	349	-.040	5.3	.175	.311	1.7	2.6	2.7	3.5	
100	1	460	40	8	-.147	4.2	.137	.371	3.4	5.0	7.9	18.1	16.2
130	1	480	31	2	-.179	4.3	.139	.408	3.1	4.4	7.0	12.5	
200	1	480	29	24	-.190	4.6	.151	.451	3.0	5.3	7.4	15.6	18.1
230	1	500	1	43	-.191	5.3	.178	.538	2.6	4.2	6.0	7.2	
300	1	510	7	56	-.230	5.0	.167	.540	2.3	3.3	5.0	12.4	12.0
330	1	520	353	66	-.171	4.5	.149	.440	2.3	2.8	3.2	6.5	
400	1	530	333	39	-.244	3.1	.097	.327	3.8	4.2	5.6	7.1	15.5
430	1	540	77	29	-.373	2.5	.079	.308	8.9	13.9	20.2	22.6	
500	1	550	72	354	-.283	3.8	.124	.441	2.4	3.3	4.7	11.0	24.8
530	1	540	40	359	-.205	4.3	.141	.448	2.2	4.4	5.8	10.7	
600	1	520	20	342	-.149	6.3	.216	.611	1.7	2.6	2.7	2.8	12.0

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
630	1	490	23	343	-.183	5.5	.186	.550	2.2	3.0	4.0	4.6	
700	1	480	18	351	-.172	6.0	.209	.600	1.8	2.7	3.2	3.4	5.6
730	1	440	27	358	-.238	5.1	.174	.541	1.8	3.5	4.4	8.8	
800	1	420	61	39	-.700	3.4	.114	.500	4.7	7.2	8.5	14.9	24.2
830	1	380	333	295	-2.553	2.0	.068	.447	5.9	7.4	7.1	13.7	
900	1	360	112	54	-1.724	2.0	.068	.385	5.7	8.2	8.5	9.0	11.9
930	1	300	221	166	-1.606	2.1	.070	.365	4.7	9.0	10.5	24.5	
1000	1	230	130	99	-1.980	1.9	.065	.332	5.4	9.3	7.3	19.9	39.6
1030	1	200	214	102	-2.373	1.6	.056	.291	6.0	6.4	8.3	10.0	
1100	1	200	261	144	-4.352	1.1	.040	.255	23.7	33.2	35.0	47.4	38.9
1130	1	200	342	228	-2.237	1.5	.053	.267	6.5	8.1	9.0	12.6	
1200	1	200	357	254	-.845	2.4	.076	.279	3.3	4.3	4.9	7.6	16.6
1230	1	200	24	248	-.251	4.6	.151	.368	2.9	8.8	12.5	18.3	
1300	1	200	348	267	-.169	4.6	.151	.323	1.9	2.6	3.0	3.2	16.1
1330	1	200	356	267	-.181	4.0	.127	.278	1.9	2.7	3.3	3.8	
1400	1	200	359	280	-.149	3.9	.125	.258	1.6	2.6	3.1	5.3	7.9
1430	1	200	358	281	-.086	4.3	.136	.235	1.7	2.2	2.2	2.4	
1500	2	200	0	290	-.004	5.9	.194	.131	1.6	2.3	2.4	2.5	5.1
1530	2	200	357	285	.005	7.0	.234		1.6	2.1	2.9	3.5	
1600	2.	200	355	282	-.007	7.4	.255	.192	1.6	1.9	2.0	2.3	3.2
1630	2	200	356	285	-.008	7.7	.267	.207	1.8	2.0	2.2	2.5	
1657	2	200	1	288	-.005	7.7	.267	.180	1.4	1.9	1.9	2.3	2.9
1724	2	200	357	292	-.005	8.4	.293	.193	1.5	1.8	1.8	2.5	
1751	2	200	2	293	-.004	7.7	.264	.173	1.6	2.0	2.0	2.2	2.3
1818	2	200	1	295	-.006	6.8	.230	.163	1.8	2.2	2.5	2.7	
1845	2	200	3	298	.003	5.8	.188		1.5	2.2	2.3	2.4	2.9
1912	2	200	10	306	.009	4.6	.144		2.0	3.1	3.5	4.7	
1939	1	200	334	262	-.126	2.6	.080	.156	6.8	12.5	22.8	58.3	46.1
2006	1	200	185	92	-1.085	2.5	.080	.318	2.1	3.7	3.6	4.4	
12/12													
901	1	200	217	64	-2.770	2.5	.084	.455	3.4	4.3	4.3	4.7	
931	1	200	307	69	-1.779	2.9	.100	.466	2.5	3.9	4.8	8.8	7.3
1001	1	100	29	20	-.977	3.8	.128	.389	3.0	7.5	13.1	37.7	
12/13													
730	1	380	249	57	-.239	2.0	.063	.187	3.8	4.5	5.1		
801	1	350	249	67	-1.394	.8	.029	.150	18.9	23.4	25.8	27.6	
831	1	340	262	76	-1.297	1.2	.040	.203	11.3	12.7	13.7	13.7	
900	1	350	236	52	-1.121	1.5	.052	.250	5.6	7.1	9.5	12.7	17.9
928	1	320	253	67	-.510	2.4	.073	.265	2.0	3.3	2.9	4.1	
1000	1	280	265	74	-.562	1.9	.061	.213	4.9	6.7	8.3	17.2	13.2
12/10													
1857	1	100	49	343	1.554	2.6	.045		2.8	3.8	5.2	11.1	
12/13													
1030	1	160	290	113	-.945	1.6	.053	.179	6.2	8.0	10.1	11.3	
1130	1	100	207	7	-.788	2.0	.064	.181	9.3	12.7	23.6	76.4	
1200	1	80	338	257	-.277	2.7	.084	.156	3.6	8.3	12.2	25.1	61.2
1230	1	50	336	270	-.540	1.8	.057	.113	3.3	4.6	6.1	6.8	
1200	1	80	338	257	-.277	2.7	.084	.156	3.0	9.0	12.3	25.1	
1230	1	50	336	270	-.540	1.8	.057	.113	3.5	5.3	6.0	6.8	

BLM-3 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1300	1	160	345	281	-.218	3.7	.120	.258	1.9	3.0	4.0	6.2	8.4
1330	1	180	346	286	-.193	5.0	.169	.363	1.8	3.2	3.5	3.6	
1400	2	120	341	287	-.089	5.0	.166	.240	1.9	3.8	4.0	4.0	3.9
1430	2	100	335	284	-.'30	5.5	.184	.285	1.8	2.6	2.6	3.6	
1500	2	100	337	284	-.057	6.4	.217	.256	1.4	2.1	2.4	2.4	3.0
1530	2	100	342	296	-.038	6.8	.233	.241	1.5	2.2	2.3	3.0	
1600	2	100	341	292	-.003	7.1	.240	.105	1.3	2.1	2.0	2.4	3.8
1630	2	100	338	291	.020	7.0	.234		1.2	2.0	1.9	1.9	
1700	2	100	340	295	.031	6.4	.208		1.6	2.0	2.3	2.7	2.9
1730	2	60	339	293	.078	5.4	.166		1.5	2.4	2.5	3.3	
1800	2	100	339	293	.070	5.5	.172		1.2	1.9	1.8	2.7	3.0
1830	2	100	350	303	.062	6.0	.192		1.3	2.1	2.9	5.6	
1900	2	100	349	307	.105	4.9	.150		1.8	2.9	3.2	3.9	5.2
1930	1	100	351	310	.355	2.9	.074		2.3	3.4	4.0	4.6	
2000	1	100	21	340	1.488	2.2	.039		3.9	7.1	11.4	21.6	22.0
2030	1	100	275	239	0.000	1.2	0.000		12.7	22.6	29.6	51.5	
2130	1	100	148	114	-.360	1.4	.044	.098	3.6	4.3	5.9		
2200	1	100	154	122	-.485	1.1	.035	.086	4.9	7.9	7.3	10.7	11.2
2230	1	60	160	111	-.327	1.2	.038	.069	4.4	6.3	7.7	17.9	
2300	1	150	149	103	-.579	1.1	.035	.104	3.4	5.8	6.8	18.5	18.6
2330	1	120	214	77	-2.061	.9	.031	.129	11.4	15.9	17.5	31.9	
12/14													
0	1	100	205	55	-3.365	.7	.026	.119	7.0	10.6	9.6	25.1	
29	1	100	217	67	-2.941	1.0	.036	.157	7.3	10.4	10.4	16.7	
58	1	100	206	42	-1.958	1.1	.039	.152	5.8	7.1	8.8	17.6	21.4
127	1	100	183	30	-.845	1.6	.053	.155	4.3	5.8	6.9	9.2	
156	1	100	30	13	-.022	3.0	.089	.081	3.1	3.5	3.5	3.8	10.7
225	1	100	353	355	-.200	3.1	.098	.175	2.4	3.0	3.8	5.6	
254	1	100	13	10	-.257	3.2	.099	.194	2.5	4.6	6.0	12.7	11.7
323	1	100	30	332	-.329	2.3	.071	.151	2.7	4.8	5.6	14.5	
352	1	100	23	305	-.118	4.0	.128	.192	2.0	3.6	5.0	6.4	17.4
421	1	100	23	326	-.075	4.1	.131	.170	2.0	3.3	4.5	9.2	
450	1	100	57	358	-.139	3.0	.094	.149	2.9	8.9	13.0	39.2	32.6
519	1	100	162	83	-1.954	1.3	.044	.170	3.8	5.4	5.1	7.1	
548	1	100	167	87	-2.710	1.2	.043	.183	6.2	10.1	14.2	26.2	19.3
617	1	100	137	58	-5.222	.8	.033	.176	7.5	13.1	22.7	35.9	
646	1	100	338	259	-5.387	.8	.030	.163	16.7	18.3	29.9	42.4	80.6
728	1	100	98	32	-2.227	1.4	.049	.196	6.4	13.5	15.0		
800	1	100	88	32	-1.114	2.0	.064	.205	3.2	4.8	6.3	6.6	
830	1	100	79	27	-1.022	1.7	.056	.174	3.9	6.0	6.6	7.1	7.2
900	1	100	58	359	.204	1.4	.038		5.5	9.2	11.2	20.0	
930	1	100	29	327	.024	1.4	.042		4.7	7.0	8.3	11.7	23.1
1000	1	100	5	300	-.149	1.0	.032	.056	3.8	6.1	9.0	10.1	
1030	1	100	13	303	.279	2.9	.078		3.0	10.9	16.1	25.0	19.1
1100	1	100	349	323	.190	4.2	.118		3.2	8.0	9.1	14.1	
1130	1	100	353	293	.194	5.1	.149		1.3	2.1	3.0	3.1	10.7
1200	2	100	352	293	.166	5.8	.176		1.3	2.4	2.5	2.7	
1230	2	150	351	293	.093	6.5	.206		1.3	2.2	2.3	2.4	2.6
1300	2	200	349	294	.078	6.3	.201		1.6	2.1	2.2	2.3	

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1330	2	150	349	294	.045	7.1	.235		1.4	2.1	1.9	2.1	2.2
1400	2	180	343	293	.023	8.7	.314		1.6	1.8	2.1	2.1	
1430	2	200	344	292	.012	9.7	.354		1.8	2.0	2.1	2.2	2.2
1500	2	200	344	294	.005	9.8	.358		1.4	2.2	2.1	2.2	
1530	2	180	344	293	.013	9.5	.348		1.4	1.7	1.8	1.8	2.0
2300	1	240	348	301	-.225	4.2	.137	.343	2.2	3.4	3.1	5.2	
2330	1	260	348	296	-.176	5.3	.177	.4'7	1.9	2.5	2.8	3.7	5.2
12/15													
0	1	300	17	337	-.240	3.5	.113	.309	3.2	8.6	16.1	41.9	
30	1	300	90	96	-.446	4.3	.145	.490	2.2	3.6	3.9	8.4	
100	1	300	58	110	-.695	4.2	.143	.560	1.9	2.5	2.7	2.9	9.3
130	1	300	18	120	-.891	3.8	.128	.544	2.1	2.5	3.0	5.6	
200	1	300	327	114	-.778	4.1	.141	.572	2.2	2.3	3.0	5.5	6.3
230	1	300	318	98	-.781	4.0	.135	.549	2.3	3.1	3.2	3.2	
300	1	300	315	91	-1.118	3.4	.115	.525	2.9	3.6	4.2	5.4	5.6
330	1	220	296	92	-3.200	2.2	.075	.442	3.3	4.2	4.9	5.2	
400	1	150	279	89	-2.961	2.1	.073	.367	3.9	5.8	6.6	7.4	6.5
430	1	150	208	37	-6.259	1.3	.049	.316	12.0	20.2	27.8	59.0	
500	1	150	3	219	-1.694	2.4	.078	.324	4.6	7.1	9.5	12.9	74.7
530	1	150	27	283	-.395	4.0	.132	.338	4.4	5.3	7.0	10.5	
600	1	150	6	290	-.057	7.9	.280	.378	2.8	3.5	4.3	5.2	9.1
630	1	150	29	333	-.223	5.0	.168	.357	3.4	7.2	10.8	22.0	
700	1	150	100	31	-2.065	2.2	.073	.328	5.6	8.9	12.6	24.6	37.3
730	1	150	215	142	-2.458	1.9	.065	.310	3.8	4.4	7.2	12.2	
800	1	150	326	285	-.714	3.1	.101	.318	6.7	13.1	28.4	56.4	63.3
930	1	150	358	157	-.154	6.1	.212	.398	1.9	2.6	3.9	4.0	
1007	1	150	334	167	-2.422	1.9	.064	.301	7.4	12.9	17.5	44.3	32.8
1028	1	150	20	211	-2.997	1.7	.059	.299	6.2	7.2	8.5		
1048	1	150	42	226	-1.904	2.2	.073	.315	4.8	6.8	10.0		
1108	1	150	14	288	-.193	5.6	.190	.384	4.6	8.3	13.4		
1128	1	150	330	297	-.138	4.3	.141	.255	2.4	2.8	3.3		
1148	1	150	349	287	.051	4.0	.120		2.5	2.8	3.5		
1208	1	150	15	299	.130	3.6	.103		2.0	2.5	5.6		
1228	1	150	23	324	-.183	2.2	.067	.135	6.6	8.0	9.5		
1248	1	150	4	298	.012	6.8	.225		2.1	2.4	2.9		
1308	1	150	355	299	.023	8.3	.284		2.2	2.6	3.2		
1328	1	120	6	314	.068	6.8	.220		1.9	2.7	4.1		
1348	1	100	48	10	.403	4.3	.113		2.7	4.9	13.0		
1408	1	100	36	4	1.403	4.3	.081		2.0	3.5	5.3		
1428	1	100	46	7	107.600	2.5	.002		7.3	8.1	8.2		
1448	1	100	37	350	58.830	2.8	.003		3.4	5.2	6.7		
1530	1	120	341	288	.132	6.2	.192		1.4	2.0	2.6	4.1	
1600	1	150	352	305	.171	6.7	.207		1.7	2.5	3.9	5.5	10.1
1630	1	150	351	303	.115	7.7	.248		1.7	2.5	2.7	2.8	
1700	1	150	347	297	.138	7.4	.234		1.4	1.8	1.9	2.0	3.6
1730	1	120	350	303	.199	6.2	.187		1.6	2.3	2.3	4.1	
1800	1	100	355	306	2.018	3.0	.048		2.3	3.6	4.9	5.0	4.8
1830	1	100	331	286	121.400	1.6	.001		13.8	24.1	37.2	46.1	
1900	1	100	323	280	5.686	2.8	.024		4.8	7.9	9.9	15.9	50.7

BLM-3 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1930	1	100	344	300	.135	5.9	.182		1.3	2.0	3.0	10.0	
2000	1	100	358	323	.698	4.4	.104		1.7	2.2	3.9	5.6	14.0
2300	1	250	274	306	.054	5.6	.179		1.3	2.3	2.3	2.7	
2330	1	270	278	312	.045	5.8	.186		1.1	2.2	2.5	2.9	4.1
12/16													
0	1	300	280	309	.033	5.8	.187		1.1	1.8	2.4	2.7	
30	1	200	291	322	.054	4.5	.139		1.9	3.2	3.6	6.6	
100	1	100	337	2	.407	2.3	.056		3.5	6.0	9.0	18.8	24.6
130	1	100	12	34	2.476	1.8	.026		2.5	3.5	4.6	9.3	
200	1	100	351	30	1.167	3.2	.063		1.7	2.3	3.2	3.6	7.3
230	1	100	4	29	4.100	2.1	.022		2.9	4.3	4.6	6.5	
251	1	100	14	38	1.814	2.6	.043		2.7	3.4	4.9		
313	1	100	32	30	2.870	2.5	.032		3.5	7.4	9.7		
326	1	100	48	55	.950	3.4	.073		2.4	5.9	10.1		
401	1	100	359	11	142.100	1.0	0.000		6.5	7.8	11.4		
421	1	100	334	355	100.300	1.1	.001		6.1	6.4	7.9		
441	1	100	337	6	130.800	1.4	.001		4.4	6.7	7.1		
12/14													
1559	2	100	349	297	.095	7.7	.250		1.2	1.6	1.7		
1612	2	100	340	294	.086	7.5	.243		1.4	1.7	1.8		
1625	1	130	345	294	.045	7.5	.249		1.5	1.6	2.2		
1638	1	130	341	296	.030	7.6	.255		1.2	1.5	1.7		
1651	1	140	344	298	.027	7.8	.264		1.5	1.7	2.8		
1704	1	160	341	298	.028	7.8	.263		1.3	1.9	1.7		
1717	1	160	350	305	.048	6.8	.223		1.4	1.5	1.9		
1730	1	160	346	308	.082	6.7	.215		1.4	1.7	2.0		
1743	1	160	351	309	.122	6.6	.206		1.3	1.6	2.3		
1756	1	160	347	306	.118	6.1	.190		1.3	1.6	2.5		
1809	1	160	346	306	.097	5.9	.183		1.2	1.8	2.3		
1822	1	160	353	313	.106	5.1	.154		2.2	4.4	2.4		
1835	1	160	352	319	.067	4.9	.150		3.2	5.8	100.0		
1848	1	160	349	304	0.000	6.9	.233	.074	1.3	1.8	2.1		
1929	1	170	347	303	0.000	5.6	.181	.058	1.5	2.0	2.1	2.1	
1958	1	200	349	302	-.029	7.7	.267	.316	1.3	2.0	2.3	2.5	
2030	1	200	345	300	-.036	9.4	.352	.447	2.1	2.4	2.6	2.7	
2100	1	200	344	298	-.022	10.1	.379	.409	1.7	2.1	2.0	2.0	
12/16													
501	1	100	337	21	4.051	2.2	.024		3.1	4.1	7.0		
521	1	100	330	14	1.922	2.4	.038		3.7	6.0	8.0		
541	1	100	332	19	1.734	2.4	.041		2.5	3.6	5.7		
601	1	100	11	43	1.543	2.0	.036		3.3	5.5	6.8		
621	1	100	24	50	.773	2.7	.059		2.4	3.1	4.2		
641	1	100	332	42	.344	3.6	.095		1.7	2.4	2.5		
701	1	100	318	41	.389	3.4	.087		1.8	2.1	2.8		
721	1	100	309	35	.263	4.7	.132		1.4	1.6	1.9		
741	1	100	327	20	.235	4.9	.139		3.5	5.9	8.3		
801	1	100	327	21	.146	5.6	.171		2.1	2.3	2.5		
821	1	100	253	353	.424	3.4	.086		2.5	6.7	13.9		
841	1	100	289	29	.264	4.1	.114		1.6	2.5	2.5		

BLM-3 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
901	1	100	297	24	.273	4.6	.128		1.8	2.8	2.6		
921	1	100	294	23	.327	4.1	.112		2.2	3.4	4.5		
941	1	100	293	9	.423	4.6	.121		1.8	2.0	2.7		
1001	1	100	293	358	.532	4.5	.115		1.3	1.6	2.2		
1021	1	100	290	345	.739	4.5	.104		1.5	2.2	3.6		
1041	1	100	281	315	.748	3.6	.081		2.4	4.3	6.9		
1101	1	100	280	308	.464	3.7	.092		1.2	1.8	2.3		
1129	1	100	15	296	.325	4.6	.124		1.3	1.8	3.4		
1144	1	100	13	291	.488	4.2	.106		1.0	1.7	2.6		
1159	1	100	3	279	1.245	3.0	.058		2.6	3.1	4.1		
1214	1	100	359	270	.772	2.6	.058		2.6	4.0	5.7		
1229	1	100	1	273	.555	2.9	.070		2.1	2.6	5.2		
1244	1	100	13	292	.473	3.6	.090		1.7	2.9	5.0		
1259	2	100	14	293	.311	4.2	.113		1.2	2.0	2.3		
1314	2	100	25	307	.103	6.5	.204		1.5	2.0	5.2		
1329	2	100	20	299	.064	7.9	.261		1.4	1.9	3.4		
1400	2	100	17	296	.032	7.2	.240		1.5	1.8	1.8	2.3	
1430	2	100	19	300	.027	6.8	.226		1.3	1.5	1.8	3.0	3.0
1500	2	100	28	313	.027	6.4	.211		1.4	1.6	2.3	4.3	
1530	2	100	33	321	.030	6.2	.201		1.5	2.1	2.5	3.7	5.7
1600	2	100	35	324	.029	6.2	.200		1.5	1.6	2.7	4.1	
1700	2	150	274	316	.027	6.5	.214		2.0	2.3	2.4	3.1	
1730	2	150	270	314	.034	6.5	.213		1.8	2.2	2.4	2.5	3.0
1800	2	150	273	321	.017	7.2	.240		1.7	2.1	2.5	4.6	
1830	1	150	275	321	.028	7.5	.253		1.9	2.7	3.6	5.7	5.2
1900	1	150	285	322	.028	9.1	.329		1.2	1.5	2.0	4.2	
1930	1	150	278	339	.061	6.9	.224		2.0	3.0	5.4	7.5	7.0
2000	1	150	275	344	.090	6.1	.191		2.0	3.4	3.4	3.7	
2030	1	150	282	341	.105	4.7	.141		1.9	3.5	5.4	6.7	12.7
12/17													
830	1	150	53	87	-.229	3.3	.105	.226	1.8	3.8	10.3	21.6	
900	1	150	173	144	-.061	7.1	.245	.340	1.9	3.9	5.9	0.0	18.1
930	1	150	13	88	-.852	2.0	.064	.215	3.7	5.3	6.7	9.9	
1000	1	150	23	84	-.218	2.7	.083	.177	2.9	6.4	15.8	41.4	8.5
1030	1	150	38	79	-.119	3.3	.101	.176	2.0	3.5	12.8	25.0	
1100	1	150	355	105	-.060	2.7	.082	.116	3.4	3.9	4.8	8.2	13.5
1130	1	150	339	119	-.111	2.7	.080	.137	2.0	6.0	11.1	20.1	
1200	1	150	344	120	-.274	2.4	.074	.169	3.9	6.9	23.1	61.5	6.1
1230	1	170	6	65	-2.895	.7	.027	.140	4.5	7.6	16.2	42.9	
1300	1	220	17	20	-1.370	1.5	.050	.221	3.3	5.8	11.1	14.6	31.9
1330	1	220	25	37	-.931	2.1	.067	.261	.6	1.1	1.8	3.2	
1400	1	230	45	66	-.368	3.5	.112	.324	1.0	1.8	3.0	5.3	17.9
1430	1	180	25	69	-.343	3.0	.095	.249	1.3	2.3	3.8	6.8	
1500	1	180	28	88	-.261	2.9	.090	.214	3.0	6.2	13.6	40.1	13.7
1530	1	180	20	94	-.151	1.8	.056	.114	4.8	5.2	8.3	15.2	
1600	1	150	342	271	-.040	1.6	.048	.065	3.6	8.5	17.4	56.7	92.7
1630	1	150	328	259	-.065	2.7	.082	.117	2.3	5.1	10.6	42.4	
1700	1	170	331	251	-.212	2.4	.072	.158	2.2	7.5	15.1	46.2	10.3
1730	1	170	350	258	-1.730	.9	.032	.141	2.3	7.3	21.2	46.6	

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1800	1	200	14	99	-1.013	1.2	.040	.157	11.5	26.0	46.7	58.2	39.9
1830	1	160	7	150	-.609	1.1	.038	.116	2.4	5.3	9.4	16.9	
1900	1	150	352	241	-1.983	.7	.027	.118	4.4	7.7	27.0	80.9	53.3
1930	1	150	60	58	.725	1.8	.040		7.0	19.7	32.0	44.4	
2000	1	150	246	129	.683	1.0	.024		7.4	10.3	13.2	15.3	37.7
2030	1	150	5	335	1.781	1.5	.025		3.5	8.3	15.8	20.9	
2100	1	150	86	132	.103	4.3	.126		1.2	2.0	3.6	4.7	21.7
2130	1	150	76	137	.088	5.2	.159		1.0	1.4	1.8	2.6	
2200	1	150	76	134	.058	6.2	.197		.8	1.5	1.7	2.8	3.1
2230	1	150	76	131	.026	6.5	.213		.8	1.3	1.7	1.8	
2300	2	150	78	135	.010	7.0	.233		1.1	1.6	2.1	5.1	4.1
2330	2	170	79	141	-.025	8.8	.327	.349	1.8	3.0	3.1	4.8	
12/18													
0	2	170	80	139	-.055	8.6	.306	.427	1.9	2.7	2.9	4.1	
30	2	170	81	138	-.047	9.4	.352	.464	2.1	2.9	3.2	4.1	
100	2	150	358	124	-.043	10.0	.379	.464	1.7	2.4	2.6	2.9	4.0
130	2	150	6	146	-.053	9.1	.343	.453	1.8	3.8	5.7	9.3	
200	2	250	8	144	-.080	7.9	.279	.499	2.2	3.5	4.6	6.0	8.0
230	2	250	4	138	-.122	7.4	.261	.537	2.1	3.5	3.4	3.6	
300	2	250	10	147	-.123	7.5	.267	.553	2.2	3.1	4.5	5.8	6.5
330	1	250	227	247	-.149	6.6	.228	.503	1.7	100.0	100.0		
400	1	250	173	161	-.074	6.8	.234	.407	2.6	3.3	3.7	3.9	10.5
430	1	250	177	173	-.059	7.2	.250	.405	2.2	2.8	3.7	7.0	
500	1	250	242	193	-.097	6.6	.228	.437	4.7	100.0	100.0	0.0	12.7
530	1	250	173	174	-.053	7.0	.243	.379	3.0	100.0	100.0		
630	1	250	343	239	-.079	6.0	.202	.361	3.8	7.2	12.4		
700	1	250	328	151	-.076	6.3	.213	.375	2.5	5.2	8.1		

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
6/20													
1851	1	750	30	165	0.000	3.3	0.000		6.9	12.7	21.4		
1902	1	750	25	173	0.000	3.7	0.000		100.0	41.0	100.0		
1957	1	750	68	308	0.000	4.3	0.000		4.2	6.9	12.0		
2030	1	750	6	320	-.555	3.4	.109	.542	9.1	20.3	100.0		
2214	1	750	305	341	-.407	3.9	.128	.575	2.1	5.4	9.6	25.8	
2300	1	750	337	325	.746	3.5	.080		2.5	6.1	29.3		
6/21													
0	1	750	314	354	2.237	2.2	.034		3.3	4.3	5.2	9.4	
30	1	750	235	310	.460	4.1	.105		.2	5.1	100.0	21.9	
100	1	750	247	293	.183	5.1	.150		1.6	2.4	3.2	4.3	
130	1	750	95	291	-.003	4.6	.146	.140	1.6	2.7	4.6	8.1	6.9
200	1	750	96	336	.005	6.3	.209		1.6	2.8	4.3	7.8	
230	1	750	66	316	.188	3.9	.112		2.2	4.0	5.0	8.4	13.8
300	1	750	90	305	.128	3.8	.109		.9	1.4	1.8	2.3	
330	1	750	89	297	.046	4.2	.129		1.0	2.0	2.5	4.0	5.5
400	1	700	87	299	-.056	3.8	.119	.268	.9	1.4	1.8	2.3	
430	1	700	93	299	-.172	3.2	.101	.329	1.0	1.7	2.1	2.9	2.9
500	1	700	11	301	-.071	4.5	.144	.351	2.6	5.6	7.0	19.7	
530	1	700	303	298	.147	3.1	.088		4.9	6.6	8.7	12.1	18.6
600	1	700	308	305	.245	2.2	.058		9.8	14.7	18.7	30.0	
630	1	700	89	295	.279	1.8	.048		1.8	3.4	7.9	22.9	33.6
700	1	650	33	276	.072	1.8	.051		1.7	2.7	3.6	5.0	
730	1	700	85	265	-.034	2.1	.063	.124	1.5	2.6	3.6	4.0	5.7
800	1	700	74	247	-.104	2.6	.080	.222	2.2	7.4	14.2	24.4	
830	1	750	81	265	-.818	2.1	.067	.375	3.9	8.2	17.7	30.8	28.1
935	1	750	337	296	-.325	3.9	.128	.527	2.3	6.0	9.3	13.7	
1030	1	850	81	275	.438	2.7	.065		1.3	2.0	2.6	2.8	
1100	1	820	18	275	.415	3.4	.085		1.8	3.2	4.6	6.7	5.1
1130	1	850	327	271	18.170	1.9	.006		2.4	3.7	4.2	4.8	
1200	1	810	266	275	12.650	2.1	.010		2.7	3.7	4.9	9.2	8.6
1300	2	840	25	278	1.152	3.3	.066		2.1	2.4	2.8	3.0	
1330	2	860	12	281	.563	4.2	.105		1.7	1.9	2.4	2.8	3.3
1400	2	850	3	285	.377	4.5	.121		1.4	2.2	2.7	3.4	
1430	2	800	358	280	.283	5.0	.141		1.3	2.2	2.5	2.9	3.7
1500	2	850	354	279	.258	5.1	.145		1.3	1.9	2.6	3.1	
1530	2	862	349	277	.312	4.6	.128		1.1	1.6	2.0	2.0	2.8
1600	2	870	336	272	.426	4.2	.108		1.1	1.9	2.3	4.1	
1630	2	870	332	272	.630	3.6	.085		1.0	1.2	2.2	4.8	4.5
1700	2	870	327	281	.806	3.2	.072		1.1	1.6	1.7	2.8	
1730	2	860	320	270	.552	3.3	.080		1.0	1.4	1.4	3.2	5.9
1800	2	850	319	273	.486	3.3	.082		.9	1.4	2.9		
1830	2	800	321	282	.905	2.6	.055		2.0	3.5	5.7	10.7	
2030	2	800	316	283	.129	3.9	.113		1.2	1.6	1.8	2.4	
2100	2	800	321	283	.082	4.8	.145		1.2	1.5	2.0	2.2	2.3
2130	2	800	326	288	.062	5.5	.175		.9	1.2	1.8	2.2	
2200	2	800	325	293	.086	4.9	.151		1.3	2.1	2.2	2.7	3.5
2230	2	800	329	301	.048	6.1	.197		.8	1.8	2.5	2.9	
2300	2	800	316	296	.070	5.5	.171		1.1	1.7	1.8	2.8	3.6

Time	Code	Zi	Rel	WD	10/L	U	U*	u*	1m	3m	10m	30m	60m
2330	2	800	296	289	.084	5.2	.160		1.1	1.6	2.1	2.9	
6/22													
0	2	800	289	291	.105	5.1	.156		.9	1.3	1.4	2.9	3.1
30	2	800	299	301	.129	4.7	.139		1.0	1.4	2.4	5.9	
100	2	800	311	306	.208	3.7	.101		1.3	2.1	3.0	3.8	5.4
130	1	800	301	303	.294	3.1	.083		2.6	4.1	4.6	5.7	
200	1	800	306	306	.317	3.2	.084		2.1	3.9	4.4	10.0	8.2
230	1	800	321	345	.894	2.1	.045		4.8	7.2	11.0	14.6	
300	1	750	331	350	.773	2.2	.047		1.9	3.2	5.2	7.9	11.9
330	1	750	313	345	.411	2.0	.050		1.7	2.3	3.1	3.5	
400	1	700	298	323	.270	1.8	.048		1.8	3.0	4.4	5.6	11.3
430	1	700	296	320	-.078	1.7	.050	.129	1.9	3.3	3.4	9.3	
500	1	680	310	332	-.033	2.1	.063	.120	1.4	2.3	4.0	5.3	9.5
530	1	680	304	324	-.091	2.3	.068	.179	1.2	2.0	3.0	7.3	
600	1	670	314	307	-.021	2.9	.086	.140	1.4	1.7	2.0	2.5	9.9
630	1	660	315	297	.014	3.1	.092		1.5	2.3	3.2	5.2	
700	1	660	333	295	.140	3.1	.086		1.9	3.2	4.8	5.8	5.7
800	1	650	7	320	.629	2.9	.066		3.2	5.7	6.4	13.4	
830	1	600	38	13	5.687	1.9	.016		4.8	7.2	8.5	11.8	29.9
900	1	600	18	356	163.800	1.0	0.000		9.2	16.8	26.5	37.6	
930	1	600	335	245	118.400	1.8	.001		5.0	7.3	14.6	26.5	63.6
1000	1	600	6	219	184.100	1.6	.001		5.0	8.1	8.3	9.0	
1030	1	600	355	218	104.900	2.5	.002		2.6	4.5	6.0	7.4	8.2
1100	1	600	336	207	4.395	2.7	.028		1.7	2.7	3.5	3.7	
1200	1	600	71	221	97.180	1.6	.001		4.8	6.9	8.7	11.1	
1230	1	650	75	228	22.560	1.6	.004		4.1	6.0	8.1	8.5	10.6
1300	1	520	71	231	1.314	2.5	.047		2.5	3.1	4.3	5.9	
1400	1	400	7	249	.380	4.0	.104		3.4	5.8	8.6	12.4	
1430	1	340	4	262	.411	4.0	.104		1.3	2.1	3.0	5.5	10.8
1500	2	300	358	266	.347	5.0	.137		1.3	1.9	2.5	4.1	
1530	2	300	349	263	.158	6.5	.200		1.3	1.9	2.1	2.4	3.6
1600	2	300	341	268	.231	6.2	.183		1.2	1.8	2.0	2.5	
1630	2	350	337	270	.439	5.1	.136		1.6	2.3	2.9	3.9	3.3
1700	2	400	330	271	.466	4.9	.128		2.1	3.3	4.6	4.6	
1730	1	450	329	279	.388	4.8	.130		1.3	1.9	2.2	2.3	5.6
1800	1	480	318	274	.365	4.4	.118		2.0	3.1	3.3	3.7	
1830	1	520	321	288	.450	3.7	.093		2.1	3.8	5.1	5.9	9.5
1900	1	540	304	272	.285	3.8	.103		3.2	4.7	6.1	8.8	
1930	1	575	317	285	.287	3.4	.090		4.1	7.0	9.6	11.6	12.1
2000	1	560	303	278	.454	2.6	.063		4.0	5.8	8.1	13.4	
2030	1	620	296	280	.358	2.6	.065		4.3	6.5	8.6	11.1	12.4
2100	1	580	287	274	.201	2.8	.076		4.6	11.2	14.2	19.1	
2130	1	620	291	289	.409	1.9	.047		5.0	8.8	9.0	20.3	20.9
2200	1	630	297	303	.368	2.1	.054		5.2	10.1	13.5	16.0	
2230	1	630	288	304	.471	2.0	.048		4.3	7.4	13.5	16.0	15.9
2300	1	630	298	316	.070	2.2	.063		4.1	8.0	9.8	12.9	
2330	1	620	265	269	-.271	2.5	.076	.277	2.8	4.9	9.3	25.4	30.2
6/23													
0	1	590	324	221	-.108	2.9	.089	.234	1.9	3.3	5.5	9.7	

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
30	1	590	358	317	-1.143	2.0	.066	.380	10.4	20.3	25.8	29.5	
100	1	590	351	307	-.254	3.9	.126	.444	2.4	3.3	4.9	5.2	21.8
130	1	590	357	314	-.940	2.1	.069	.372	4.9	8.4	13.2	14.4	
200	1	590	6	350	-1.069	1.6	.053	.298	8.2	16.0	17.6	23.0	25.1
230	1	590	358	329	37.610	1.0	.002		8.5	14.2	20.1	20.0	
300	1	590	354	345	.080	1.9	.054		8.5	12.9	15.9	17.6	20.8
330	1	590	336	72	-.617	2.1	.066	.313	4.5	9.7	13.1	19.1	
400	1	590	339	45	.188	1.9	.052		.1	2.5	4.7	8.6	17.6
430	1	590	343	29	-1.249	2.0	.065	.385	3.3	5.1	6.0	7.1	
500	1	590	358	0	-1.849	1.9	.063	.428	.5	1.3	3.0	5.5	29.2
530	1	570	39	312	-.629	3.0	.096	.450	.8	2.4	4.4	8.0	
600	1	560	306	319	-.392	3.9	.130	.516	1.1	2.0	3.0	5.3	16.3
630	1	560	316	340	-.565	3.5	.115	.519	.5	.9	1.3	2.3	
700	1	560	342	324	-1.749	1.5	.053	.347	.4	.7	1.1	1.9	26.4
830	1	580	315	165	-.714	1.1	.036	.179	5.5	10.2	14.5	22.0	
900	1	600	17	207	-.743	1.5	.050	.252	7.5	10.4	14.8	17.0	28.9
1020	1	600	356	355	-.832	1.6	.052	.270	4.9	6.3	8.4	10.5	
1050	1	620	357	343	-1.150	1.3	.043	.257	3.7	5.5	7.2	7.6	11.3
1204	1	550	357	290	-.096	4.4	.143	.355	2.1	3.4	4.3	7.8	
1234	1	550	1	296	.029	3.3	.099		2.0	3.0	3.8	3.9	6.6
1444	1	460	15	248	25.850	2.5	.006		2.5	3.8	6.0	9.8	
1524	1	450	349	240	1.900	3.6	.060		1.9	3.4	4.2	6.2	
2034	1	510	358	291	.026	7.0	.232		1.7	3.1	3.7	6.0	
2140	1	400	42	346	-.059	5.3	.175	.332	2.6	4.8	7.1	13.0	
2210	1	420	14	314	-.072	4.9	.160	.331	3.1	5.3	7.6	8.8	20.0
2337	1	300	16	4	-.164	3.1	.096	.234	5.0	9.5	11.8	14.1	
6/24													
7	1	260	13	32	-.068	5.6	.188	.324	2.4	3.6	4.8	8.3	
158	1	420	344	285	-.057	5.7	.190	.363	1.4	2.0	2.4	2.5	
228	1	500	357	294	-.072	5.8	.195	.425	1.5	2.5	3.1	3.2	4.7
401	1	600	354	295	-.065	5.9	.198	.443	2.0	3.1	5.1	8.7	
431	1	550	2	302	-.115	4.7	.154	.406	1.7	2.5	4.2	5.9	8.3
526	1	500	6	316	-.209	4.2	.138	.428	2.0	3.3	3.9	5.1	
648	1	550	357	285	-.165	4.1	.130	.386	3.3	8.3	9.2	19.2	
748	1	500	276	188	-.195	3.7	.116	.353	3.4	5.5	7.7	8.9	
830	1	450	64	306	.234	2.3	.061		3.6	7.0	14.3		
858	1	460	15	343	.323	2.4	.060		3.0	6.7	8.9	15.4	
927	1	460	88	254	.220	3.2	.086		3.5	8.8	16.3	17.0	45.2
1000	1	400	79	254	.258	2.7	.072		4.3	9.0	17.4	21.6	
1030	1	380	102	289	.111	2.7	.075		4.1	11.2	15.1	28.8	31.2
1100	1	340	49	298	.043	5.2	.163		2.6	5.9	13.5	13.6	
1130	1	300	99	314	.192	3.4	.095		3.6	7.7	12.4	21.4	19.8
1154	1	240	307	286	.006	3.7	.112		2.8	6.4	15.4		
1230	1	240	338	286	.054	5.4	.169		1.6	3.5	5.2		
1300	2	240	339	297	.129	4.7	.140		1.8	3.8	4.7	5.7	14.7
1330	2	240	315	270	.051	4.0	.118		2.4	4.9	8.0	14.2	
1400	2	240	319	267	-.007	4.9	.156	.127	2.2	4.5	7.3	9.3	12.1
1430	2	240	324	271	-.002	6.2	.206	.119	1.6	2.3	3.1	3.8	
1500	2	240	323	279	.021	6.5	.214		1.7	2.9	3.3	5.1	6.2

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1530	2	240	321	273	.025	6.3	.204		1.3	1.9	2.2	2.5	
1600	2	240	316	273	.015	5.3	.193		1.4	2.1	2.5	2.8	2.7
1630	2	240	317	269	.026	5.9	.191		1.4	1.9	2.0	2.9	
1700	2	240	319	267	.039	6.1	.197		1.4	2.3	2.6	3.2	3.3
1730	2	260	316	262	.041	6.1	.198		1.4	2.2	2.3	2.4	
1800	2	270	323	267	.035	6.6	.217		1.5	2.1	2.5	2.7	3.4
1830	2	280	328	272	.037	7.2	.240		1.5	2.4	2.8	3.8	
1900	2	300	342	284	.044	8.4	.284		1.6	2.3	2.9	4.4	7.3
1930	2	240	339	286	.061	7.6	.253		1.6	2.2	2.2	2.6	
2000	2	200	340	284	.069	6.9	.223		1.4	1.8	1.9	2.0	2.5
2030	2	200	342	289	.035	5.9	.191		2.1	2.9	3.3	3.4	
2100	2	200	344	292	.002	6.2	.206		2.1	4.0	3.5	4.5	4.4
2130	2	300	347	295	.049	6.1	.197		1.2	1.8	2.3	2.4	
2200	2	400	344	310	.194	4.9	.142		3.0	4.1	5.7		
2230	2	500	331	302	.312	4.0	.107		1.7	3.0	4.9	8.6	
2300	2	600	336	313	.268	4.5	.127		.4	2.1	3.7	6.6	9.5
2330	1	750	351	335	.761	3.4	.076		5.9	6.5	9.5	20.5	
6/25													
0	1	800	343	332	2.305	2.7	.040		3.0	4.7	5.4	5.9	
30	1	800	329	325	2.243	2.7	.041		2.2	4.1	5.6	7.0	
100	1	800	18	23	4.431	2.1	.022		3.2	7.2	13.3	25.4	34.1
130	1	820	63	72	110.400	1.0	.001		2.8	5.5	9.1	20.3	
200	1	820	64	86	313.500	.5	0.000		9.1	21.3	31.1	82.9	66.5
230	1	820	250	280	162.400	.9	0.000		6.0	13.0	17.3	27.5	
300	1	820	259	297	.524	2.4	.056		4.3	7.9	11.3	14.7	23.5
330	1	820	307	310	.158	4.3	.126		1.8	3.6	5.8	6.5	
400	1	750	309	319	.292	3.6	.095		2.0	3.7	5.0	6.4	7.7
430	1	700	314	327	.358	3.0	.076		2.4	4.1	5.6	5.7	
500	1	700	291	323	1.145	1.8	.035		3.3	7.4	8.7	12.1	9.5
530	1	740	272	312	1.149	1.9	.037		4.9	7.6	11.2	15.0	
600	1	740	285	313	3.020	2.1	.027		4.1	7.9	9.0	12.6	13.8
630	1	730	318	313	1.426	2.8	.052		2.3	4.4	5.5	6.0	
700	1	740	337	312	.328	4.2	.112		2.7	5.2	6.8	10.8	8.8
730	1	740	351	311	.166	5.1	.152		2.1	4.0	5.9	6.5	
800	1	650	1	326	.176	5.5	.165		1.6	2.9	3.7	7.1	
830	1	580	17	350	.682	3.8	.090		2.8	4.8	7.7	15.3	16.7
900	1	580	43	20	16.560	2.4	.009		2.2	3.6	5.4	6.3	
930	1	580	22	331	132.400	1.4	.001		3.7	5.6	7.7	14.7	28.1
1000	1	550	353	293	44.890	2.9	.004		3.2	4.8	5.6	10.8	
1030	1	500	357	297	1.586	4.2	.075		2.8	3.2	4.2	5.9	9.0
1100	2	380	329	286	.372	6.2	.175		1.2	1.6	1.7	2.0	
1130	2	320	326	284	.264	6.6	.196		1.1	1.5	1.8	2.0	2.1
1200	2	300	321	283	.212	6.9	.210		.9	1.2	1.6	2.5	
1230	2	200	315	279	.139	7.5	.239		1.1	1.4	1.5	1.7	3.5
1300	2	250	315	277	.097	8.4	.278		1.2	1.5	1.6	1.6	
1330	2	210	317	278	.069	9.3	.328		1.5	1.9	2.0	2.2	2.0
1400	2	220	319	281	.054	10.8	.388		1.3	1.5	1.6	2.0	
1430	2	180	320	291	.062	10.8	.388		1.3	1.6	1.6	1.6	1.8
1500	2	150	324	286	.057	11.4	.412		1.4	1.7	2.0	2.3	

BLM-4 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1530	2	150	322	286	.073	10.4	.372		1.4	1.6	1.7	1.9	2.1
1600	2	150	322	286	.077	10.6	.376		1.4	1.4	1.5	1.6	
1630	2	150	320	286	.075	11.1	.396		1.5	1.6	1.6	1.8	1.7
1700	2	250	324	288	.063	12.3	.445		1.5	1.7	2.0	3.1	
1730	2	320	327	294	.069	12.5	.452		1.7	1.9	2.1	3.3	4.5
1800	2	330	325	296	.080	12.4	.448		1.4	1.7	1.8	2.1	
1830	2	400	325	294	.111	10.8	.379		1.4	1.9	1.9	2.1	2.2
1913	2	400	274	283	.077	11.0	.393		2.5	3.7	4.2		
1955	2	400	343	286	.076	11.9	.430		1.6	2.3	3.0	4.2	
2025	2	400	356	303	.078	9.8	.346		1.1	1.6	1.8	3.5	
2055	2	400	353	311	.087	10.5	.371		1.5	1.8	2.0	2.9	5.
6/27													
1130	2	150	350	293	.078	11.0	.391		1.5	2.0	1.9	2.1	
1200	2	150	348	289	.090	12.0	.427		1.6	1.9	2.5	3.9	3.
1230	2	150	346	286	.042	14.9	.559		1.7	1.8	1.8	1.8	
1300	2	150	345	284	.060	14.3	.530		1.4	1.9	1.8	1.8	2.
1330	2	150	345	286	.047	14.2	.529		1.6	1.9	2.1	2.3	
1400	2	150	346	284	.049	13.9	.517		1.7	2.1	2.2		
1430	2	90	342	282	.045	14.3	.531		1.3	2.0	1.9	1.9	
1500	2	90	340	286	.042	14.8	.554		1.7	2.0	2.1	2.2	2.
1530	2	90	340	286	.048	14.7	.549		1.5	2.1	2.4	2.7	
1600	2	90	339	285	.044	15.6	.585		1.6	1.9	2.0	2.1	2.
1630	2	90	340	285	.047	15.6	.585		1.5	2.2	2.1	2.3	
1700	2	100	337	286	.075	13.0	.471		1.5	1.9	2.1	2.2	2
2000	2	250	331	292	.077	10.2	.360		1.9	2.2	2.4	2.8	
2030	2	250	331	294	.079	9.1	.321		2.0	2.9	2.9	3.0	3
2100	2	300	329	293	.098	8.0	.264		2.5	2.8	2.9	3.3	
2130	2	400	333	295	.088	8.1	.267		1.8	2.3	2.6	3.2	3
2200	2	400	337	301	.083	8.1	.270		1.9	2.5	2.7	3.0	
2230	2	400	341	306	.097	7.5	.245		1.8	3.0	3.2	4.0	4
2300	2	450	343	310	.126	6.6	.206		2.2	3.0	4.2	4.5	
6/28													
0	2	400	342	295	.122	6.2	.192		1.6	1.9	3.2	5.4	
30	1	500	354	306	.151	5.6	.170		1.6	2.4	3.3	4.8	
100	1	500	3	320	.401	4.2	.109		1.6	2.2	2.9	4.5	[illegible]
130	1	600	356	300	.333	4.3	.116		2.1	3.9	9.1	11.1	
200	1	750	11	313	.428	4.4	.114		2.2	4.3	6.2	7.6	1
230	1	750	3	309	.547	4.1	.101		2.4	3.6	4.5	5.1	
300	1	850	57	327	2.030	2.6	.040		3.2	6.3	11.4	28.0	2
330	1	800	52	320	3.627	2.3	.026		4.5	7.9	11.9	29.7	
400	1	800	303	168	126.500	1.1	.001		17.3	23.4	37.4	89.9	[illegible]
430	1	750	354	225	3.903	1.8	.020		9.4	19.2	36.0	58.5	
500	1	680	257	136	58.060	1.5	.002		13.5	20.7	28.8	53.4	[illegible]
526	1	700	94	331	8.536	1.7	.011		7.0	9.2	24.5		
600	1	700	175	49	5.521	1.7	.015		4.8	7.2	13.6	20.9	
630	1	680	50	295	1.297	2.6	.049		8.3	11.7	13.7	16.4	
700	1	680	11	260	.217	5.4	.159		2.0	3.4	5.0	8.0	
730	1	680	28	287	.563	4.2	.103		1.4	2.5	4.2	9.2	
800	1	680	25	284	.763	3.8	.087		1.8	3.5	5.2	6.4	

BLM-4

METEOROLOGICAL DATA

1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
830	1	680	38	301	1.213	3.0	.059		4.4	7.5	11.7	20.3	17.2
900	1	660	17	287	1.107	3.5	.071		1.8	4.4	8.9	10.3	
930	1	660	33	326	.736	3.9	.090		2.0	3.9	4.4	6.4	21.4
1000	1	660	2	288	.289	5.3	.150		2.0	3.7	6.0	7.9	
1030	1	660	339	282	.182	7.5	.234		1.6	2.8	3.6	4.1	6.8
1100	1	660	331	275	.263	6.4	.188		2.2	100.0	8.6		
1130	1	500	268	276	.650	4.5	.110		1.5	2.6	2.9	4.8	12.9
1200	1	400	308	244	.344	6.3	.180		1.5	2.6	5.9	7.3	
1300	2	250	323	275	.396	5.8	.159		3.1	4.6	5.7	6.9	
1330	2	250	315	263	.289	6.5	.191		1.6	3.1	3.1	3.4	7.8
1400	2	250	320	270	.339	6.3	.178		1.2	2.1	2.6	4.8	
1430	2	300	324	278	.354	6.5	.183		1.6	2.4	2.5	2.8	5.6
1500	2	400	320	272	.377	6.3	.175		1.2	1.7	1.9	3.1	
1530	2	450	322	274	.293	7.0	.206		.9	1.4	1.8	2.1	2.8
1600	2	500	325	276	.199	8.2	.259		1.0	1.5	1.7	1.8	
1630	2	500	327	279	.221	8.1	.251		.9	1.4	1.6	1.6	2.3
1700	2	500	327	281	.229	7.7	.237		1.0	1.4	1.7	2.7	
1730	2	500	323	279	.263	7.0	.210		.9	1.4	1.8	3.3	3.2
1800	2	500	322	278	.191	7.8	.243		1.0	1.9	2.3	4.0	
1830	2	500	326	285	.173	8.2	.261		.8	1.1	1.6	2.2	4.7
1900	2	500	327	290	.171	8.3	.263		.9	1.2	1.8	3.0	
6/29													
800	1	500	33	167	1.012	3.3	.068		1.7	4.0	6.6	9.3	
830	1	500	42	182	.594	3.8	.093		1.1	2.0	3.5	3.9	10.6
900	1	500	35	174	1.237	3.1	.060		1.3	2.2	4.0	4.1	
930	1	500	52	174	1.364	3.0	.056		2.3	4.2	5.8	10.6	9.1
1000	1	500	32	195	2.570	2.7	.038		1.7	3.5	4.8	7.2	
1030	1	500	53	196	.859	4.3	.097		1.1	2.3	3.4	3.6	5.8
1200	1	500	246	171	1.190	4.0	.080		1.0	1.7	3.5	7.2	
1230	1	500	325	191	1.679	3.9	.068		1.7	3.2	5.0	7.1	11.2
1300	1	500	9	211	1.810	4.0	.068		1.7	3.5	5.5	10.0	
1330	1	500	260	228	.766	4.3	.100		1.0	1.5	2.3	7.0	13.2
1430	1	500	299	221	1.231	4.0	.079		.8	1.7	2.2	3.1	
1500	1	500	293	229	1.824	3.7	.062		.5	1.0	1.9	3.2	5.2
1530	1	500	300	242	1.344	3.7	.071		.9	1.5	1.7	2.9	
1600	1	500	309	263	.744	4.4	.102		1.4	2.4	3.6	11.6	13.5
1630	1	500	327	233	.382	5.2	.142		1.0	1.6	2.6	4.7	
1700	1	500	333	278	.808	4.0	.091		1.1	2.1	3.1	5.8	5.9
1730	1	500	14	322	2.435	3.0	.044		1.4	3.9	8.1	19.0	
1800	1	500	121	58	4.424	2.5	.025		2.0	5.6	12.8	29.2	56.1
6/30													
652	1	300	352	303	-.045	7.6	.254	.415	2.3	3.0	3.0	3.0	
722	1	300	350	304	0.000	7.6	.257		2.0	2.9	2.8	3.7	3.4
926	1	200	359	316	.266	5.8	.168		1.4	2.1	2.5	2.6	
1008	1	150	7	324	.320	5.3	.147		1.9	2.4	2.3	2.7	
1038	1	150	3	322	.252	5.4	.156		1.8	2.4	2.6	2.9	3.0
1248	1	150	359	234	1.065	3.0	.061		2.5	6.4	11.0	23.6	
1318	2	150	4	269	.254	6.5	.192		.7	1.4	1.9	5.9	
1348	2	200	356	275	.270	6.5	.191		1.3	2.1	2.2	4.9	

BLM-4 METEOROLOGICAL DATA 1/2 hr AVE SIGMA THETA

Time	Code	Zi	Rel	WD	10/L	U	U*	w*	1m	3m	10m	30m	60m
1504	2	280	356	259	.279	6.7	.198		.8	1.4	1.8	2.3	
1543	2	350	3	266	.245	7.3	.222		1.0	1.6	1.7	2.7	
1613	2	400	5	274	.188	8.5	.270		1.0	1.6	2.3	2.9	5.2
1725	2	400	350	273	.113	9.3	.322		1.1	2.0	2.3	2.4	
1755	2	400	1	282	.169	8.5	.272		1.0	1.8	2.2	2.6	3.8
1825	2	450	3	287	.288	7.3	.217		1.0	1.9	1.9	2.1	
2012	2	750	6	313	.047	6.4	.209		1.6	2.1	2.5	3.0	
2042	2	750	1	310	.032	7.0	.233		1.4	2.0	2.3	2.7	3.4
2233	2	700	350	307	-.036	7.3	.254	.491	2.7	3.5	4.1	4.2	
7/01													
545	1	780	2	296	.130	6.0	.187		1.6	2.7	3.8	5.9	
833	1	780	351	285	228.800	1.3	0.000		4.5	6.0	7.7	11.8	
833	2	580	351	292	124.800	2.3	.001		4.5	6.0	7.7	11.8	
923	2	500	12	289	.366	5.8	.161		1.3	2.1	3.6	6.8	
953	2	440	9	298	.197	7.6	.236		1.4	2.4	2.3	2.5	7.0
1023	2	590	3	299	.112	8.7	.299		1.4	2.0	2.3	2.8	
1131	2	400	7	314	.033	10.1	.367		1.6	1.9	1.9	2.1	
1312	2	400	8	311	-.006	10.2	.382	.334	1.8	2.5	2.7	2.7	
1342	2	500	5	308	.007	10.0	.369		1.9	2.6	3.0	3.3	3.4
1452	1	500	8	308	.017	10.5	.384		1.9	2.8	3.1	3.4	
1522	1	400	340	312	-.006	13.7	.527	.473	1.8	2.3	2.5	2.6	3.7

Appendix D

WIND DIRECTION STANDARD DEVIATION DATA

The following tables contain all of the horizontal wind direction standard deviation data. The times indicate the end of the half hour period during which the data were accumulated. Averaging times of 1, 3, 10, 30, 60 m were used for processing the data. The tables contain the following averages:

60 m average,
30 m average,
½ hour average of the 3 10 min averages,
½ hour average of the 10 3 min averages,
½ hour average of the 30 1 min averages,
the 3 10 min averages,
the 3 10 minutes averages of the corresponding 3
    3 min averages,
the 3 10 minute averages of the corresponding 10
    1 min averages.

This rather extensive list of averages is included here because of their usefulness in determining the quality of the data and because they can be used to see how rapidly equilibrium is reached after a change in meteorological conditions.

BLM-1 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
9/23													
1642	3.4	4.0	3.1	7.2	4.9	5.3	8.0	6.8	9.6	3.5	5.9	8.1	8.5
1717	3.3	3.7	1.7	5.1	12.1	9.4	10.4	10.9	6.9	3.0	8.8	9.4	10.4
1749	4.3	4.0	4.9	5.9	6.5	9.1	6.6	7.2		4.3	6.9	6.9	9.1
9/24													
1137	5.1	4.2		7.6	6.9		14.3	6.2		4.6	7.9	10.2	10.3
1205	4.2	6.0		6.7	9.6		10.5	16.5		5.1	8.4	13.5	12.9
1233	5.1	4.0		6.5	6.0		10.8	8.9		4.7	6.8	9.9	10.1
1301	2.5	4.2		4.0	8.8		8.0	15.9		3.7	6.2	12.0	13.9
1329	4.8	5.5		6.7	7.7		10.7	8.0		5.1	7.1	9.4	9.0
1357	4.7	4.4		8.6	11.5		10.1	10.6		4.2	9.1	10.3	9.6
1425	4.3	3.1		5.4	5.6		6.9	7.3		3.6	5.8	7.1	7.9
1453	3.9	4.9		4.3	6.0		6.3	7.5		4.0	5.7	6.9	7.6
1521	2.6	3.6		6.5	5.8		8.1	7.0		3.4	7.7	7.6	8.8
1549	3.0	3.4		5.7	6.5		5.4	6.9		3.1	5.7	6.6	7.3
1617	2.9	3.7		4.5	6.9		6.8	5.5		3.0	5.6	6.1	6.6
1645	3.0	2.7		3.7	4.6		5.3	5.1		2.8	4.1	5.2	5.8
1713	2.5	3.1		6.1	5.8		6.1	6.2		2.8	5.5	6.1	6.6
1809	2.4	2.1		3.4	4.9		5.4	7.4		2.3	4.2	5.4	7.0
9/27													
743	3.6	3.4	3.4	3.7	5.4		5.1	6.7		3.5	4.6	5.9	5.7
859	4.5	5.6	5.8	6.1	8.5	12.1	6.4	9.7		5.2	8.5	8.1	8.7
945	3.2	3.5	2.2	4.1	6.1	5.2	5.6	5.8		3.0	5.1	5.7	6.2
1013	3.1	2.1	3.8	3.4	3.7		5.6	3.4		2.8	3.8	4.5	5.1
1041	1.7	2.4	4.2	2.3	4.0		3.2	5.1		2.5	2.9	4.2	5.4
1138	2.2	3.4	3.1	5.0	7.0	5.2	7.5	8.2		2.9	5.8	7.9	7.4
1206	3.0	2.3	2.5	3.5	5.3		4.7	6.0		2.6	4.3	5.4	5.8
1234	2.8	2.7	1.9	4.9	5.0		5.3	5.9		2.6	4.8	5.6	5.4
1302	2.7	3.1	2.5	3.1	4.7		3.6	6.2		2.8	4.2	4.9	5.7
1330	2.1	1.9	2.0	3.4	3.5		3.9	5.1		2.0	3.6	4.4	4.5
1358	1.9	1.8	2.1	2.1	3.1		3.4	3.4		1.9	2.5	3.4	4.9
1426	1.9	1.7	2.4	3.1	2.6		5.3	3.2		1.9	3.2	4.2	4.5
1454	1.5	1.8	1.4	1.9	3.9		2.7	3.9		1.6	3.3	3.3	3.3
1522	1.4	1.4		2.3	2.0		3.0	2.1		1.5	2.2	2.5	2.5
1550	1.4	1.2		1.8	1.7		2.0	2.2		1.2	1.8	2.1	2.0
1618	1.5	1.4	1.6	2.8	1.8		2.9	2.6		1.5	2.7	2.7	2.9
1646	1.3	1.2	1.2	2.3	1.9		2.8	2.5		1.2	2.0	2.7	3.0
1714	1.4	1.3	.9	2.4	1.6		3.1	2.3		1.3	2.0	2.7	2.9
1742	1.6	1.0		2.3	2.6		3.3	2.0		1.4	2.3	2.7	2.7
1810	1.6	1.2		2.3	2.5		3.3	2.7		1.5	2.7	3.0	4.1
1838	1.4	1.5		2.5	2.8		2.7	2.9		1.6	2.7	2.3	2.8
1906	1.8	1.6		2.6	2.6		3.2	2.9		1.8	2.9	3.0	3.1
9/28													
1307	2.7	4.9	3.5	4.0	5.5	8.4	6.9	5.4		3.7	5.7	6.2	11.4
1335	2.9	3.6	4.0	6.0	4.5		8.5	7.1		3.4	5.7	6.3	9.5
1408	1.7	2.6	2.4	1.9	5.8	4.1	3.9	5.4		2.2	3.9	4.7	7.6
1436	4.1	3.2	3.4	5.3	7.9		6.1	6.0		3.6	6.1	6.0	6.3
1504	2.8	3.6	4.7	3.4	7.2		3.5	9.5		3.5	5.2	6.0	8.7
1532	1.9	2.1	1.7	2.7	2.9		3.0	5.0		1.9	2.8	4.0	5.1

BLM-1 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1600	1.5	2.1		2.5	2.7		4.4	2.9		1.7	2.6	3.6	3.5
1628	2.1	2.3		4.0	5.8		5.0	6.2		2.2	4.7	5.6	6.1
1740	1.4	1.4	1.7	1.9	2.3	3.4	2.6	2.3		1.4	2.4	2.4	4.1
1808	1.1	1.1	2.1	1.8	1.5		2.4	1.5		1.3	1.7	2.0	3.9
1836	1.1	1.9		1.6	2.8		1.7	3.1		1.7	2.2	2.4	3.8
1904	1.6	1.2		2.3	2.5		2.5	4.4		1.6	2.4	3.4	4.7
9/29													
1217	1.9	3.3	2.9	3.6	4.4	5.0	3.9	4.4		2.7	4.3	4.2	5.1
1245	2.8	2.7	2.3	2.9	3.5	4.5	5.7	3.6		2.6	3.5	4.6	4.9
1347	1.4	1.8	1.6	2.2	3.0	2.4	2.5	3.0		1.6	2.6	2.8	2.7
1415	1.1	1.7	1.2	1.2	2.1	2.4	3.0	3.0		1.3	1.9	3.0	3.1
1443	1.5	1.6	1.4	2.1	2.1	1.6	3.5	2.4		1.5	2.0	3.0	3.0
1511	1.3	1.3	1.2	1.5	2.4	2.4	1.9	4.5		1.3	2.0	3.2	4.2
1540	1.3	5.7		1.6	3.0		2.2						
1626	1.2	1.3	1.1	1.3	1.7	3.4	2.2	1.6	2.2	1.2	2.0	2.0	2.6
1654	1.2	1.1	1.1	1.3	1.5	1.9	1.4	2.1		1.1	1.5	1.9	2.0
1722	1.0	.8	.8	1.7	1.9	1.1	2.4	1.7		.9	1.6	2.0	2.3
1750	1.1	1.1	.9	1.5	1.7	2.5	1.8	2.3		1.1	1.8	2.1	3.9
1818	.9	1.0	.8	1.0	1.2	1.8	3.4	1.7		.9	1.3	2.5	3.6
1846	.7	.9	1.0	.8	1.4	1.2	1.1	2.5		.9	1.1	1.8	3.5
1902	.9	4.1		1.1	.9		1.5						

BLM-2 WIND DIRCTION STANDARD DEVIATION (deg)

Time	10min Period: 1min Ave #1			3min Ave #1			10min Ave #1			1/2hr Period			
	1min Ave #1	#2	#3	3min Ave #1	#2	#3	10min Ave #1	#2	#3	1m	3m	10m	1/2h
1/05													
904	4.4	5.9	10.7	4.6	8.5	15.0	6.3	9.7	20.0	6.9	9.4	12.0	20.9
1/06													
1155	6.1	1.7	1.2	10.0	2.9	4.6	28.1	2.8		3.2	6.0	15.4	19.0
1225	1.4	1.3	.7	1.4	2.2	3.6	1.6	3.4		1.2	2.3	2.5	5.1
1355	1.5	1.9	2.3	3.7	4.2	4.8	4.6	8.7		1.9	4.2	6.7	13.2
1425	1.6	2.4	7.1	2.2	3.9	12.8	2.4	9.3		3.3	5.5	5.8	9.4
1455	3.7	2.7	2.1	4.6	4.3	5.6	6.4	4.9		2.9	4.7	5.6	7.8
1542	7.0	9.4	4.2	7.9	16.8	12.0	21.6	32.0		7.1	12.2	26.8	25.6
1612	2.7	3.0	2.3	3.9	7.0	3.2	3.9	7.8		2.7	4.9	5.9	8.5
1642	3.8	1.9	2.1	5.6	2.8	6.0	6.2	3.3		2.7	4.7	4.7	6.7
1712	1.4	4.5	1.9	2.0	7.1	12.2	2.4	8.7		2.7	6.5	5.6	7.4
1742	2.4	2.6	2.6	4.3	4.9	8.7	8.4	8.3		2.5	5.6	8.4	10.9
1812	1.3	1.2	5.3	2.0	3.4	8.3	4.0	3.4		2.3	4.1	3.7	6.4
1842	2.9	2.7	1.9	4.8	8.4	4.6	10.3	12.1		2.6	6.1	11.2	20.7
1912	2.3	4.0	3.4	5.0	9.3	6.9	10.2	12.1		3.2	6.7	11.1	15.0
1942	6.9	5.7	2.0	9.6	9.9	8.7	12.8	17.0		5.2	9.5	14.9	21.3
1/07													
1202	1.2	1.8	1.6	1.7	3.6	3.4	4.3	4.6		1.5	2.8	4.4	5.4
1232	1.7	1.8	2.1	2.1	2.3	2.9	2.3	2.6		1.8	2.4	2.5	3.8
1320	2.9	2.7	3.8	4.0	5.1	5.2	6.6	8.3		3.1	4.7	7.5	14.0
1350	3.7	2.4	5.4	5.6	7.7	7.2	9.3	15.3		3.7	6.8	12.3	13.5
1420	2.4	3.6	3.7	3.2	5.7	4.5	3.6	11.1		3.2	4.4	7.3	13.4
1450	3.5	4.8	3.1	4.3	11.8	8.3	4.8	23.8		3.9	8.1	14.3	34.8
1/09													
1149	3.1	1.8	1.9	5.6	2.4	4.0	16.4	3.7		2.3	4.0	10.0	12.3
1221	1.8	1.9	1.2	2.7	3.2	6.5	4.6	4.9		1.7	3.8	4.9	7.5
1309	2.4	2.2	1.6	3.9	2.9	3.4	4.6	2.6		2.1	3.4	3.6	4.0
1339	2.0	1.6	1.4	2.6	2.3	3.8	5.4	3.9		1.7	2.8	4.6	6.3
1409	1.9	2.0	1.9	2.8	2.8	3.4	3.3	2.6		1.9	2.9	2.9	3.4
1439	2.1	1.7	1.4	2.9	2.2	2.4	4.1	2.2		1.8	2.5	3.1	3.3
1509	1.4	1.6	1.2	1.4	2.1	1.7	1.4	3.8		1.4	1.7	2.5	5.4
1539	1.3	1.4	1.6	1.3	1.8	3.9	1.9	2.2		1.4	2.1	2.0	2.5
1609	1.6	1.6	2.3	1.9	3.1	5.5	3.6	3.0		1.8	3.2	3.3	4.9
1639	3.1	2.3	1.8	3.9	7.5	6.0	6.5	6.9		2.5	5.8	6.7	11.6
1709	1.7	1.4	1.3	2.2	2.2	2.1	3.1	2.0		1.5	2.2	2.5	2.7
1739	1.0	1.9	1.3	1.4	2.2	1.5	1.6	2.9		1.4	1.7	2.3	3.4
1809	1.6	1.9	1.4	2.2	2.7	3.3	2.3	3.8		1.7	2.7	3.0	4.4
1/13													
952	1.9	1.4	4.6	3.8	5.7	16.7	5.4	8.7	16.3	2.6	8.7	10.2	12.9
948	1.3	1.9	1.8	2.8	4.1	3.2	9.0	5.4	3.1	1.7	3.4	5.9	15.0
1049	3.2	1.6	1.1	6.1	3.3	2.5	7.1	3.4	1.7	2.0	4.0	4.1	11.1
1119	1.3	1.5	2.3	2.5	4.0	5.9	4.7	9.3	7.1	1.7	4.1	7.0	10.6
1239	1.5	1.3		2.8	1.9		3.9	1.7	2.9	1.4	2.7	2.9	3.1
1309	1.3	1.5	1.4	1.5	1.9	2.2	2.0	2.9	2.9	1.4	1.9	2.6	2.6
1339	1.5	1.2	1.3	2.0	2.4	2.0	3.2	6.2	2.3	1.3	2.1	3.9	6.6
1409	1.3	1.0	1.2	1.6	1.9	2.8	1.6	2.8	2.2	1.1	2.1	2.2	3.3
1439	1.2	1.2	1.4	1.3	1.7	3.3	1.6	2.7	3.5	1.3	2.1	2.6	5.5
1509	1.2	1.2	1.4	2.2	2.5	3.5	3.0	2.4	3.6	1.3	2.7	3.0	5.8

BLM-2 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1521	1.1	3.0		2.0			4.6						
1559	1.2	1.4	1.3	2.2	3.2	6.2	2.7	4.5	8.2	1.3	3.9	5.1	7.0
1629	1.4	1.2	1.4	2.7	2.6	5.0	3.2	2.4	5.1	1.4	3.4	3.6	5.8
1659	1.2	1.6	1.4	2.0	5.4	5.1	5.7	7.0	4.1	1.4	4.1	5.6	10.6
1729	1.4	1.8	1.5	1.9	2.4	2.3	3.6	2.4	1.9	1.6	2.2	2.6	7.7
1/14													
1130	1.6	2.1		2.5	3.4		7.2	4.5	6.1	2.0	4.2	5.9	15.7
1200	1.7	24.6	8.3	2.3	24.0	42.2	7.2	63.7	24.1	12.0	22.8	31.7	61.6
1230	5.2	4.3	5.8	5.4	6.1	8.6	6.6	7.5	10.3	5.1	6.7	8.1	10.4
1300	3.1	4.9	4.2	11.4	6.7	7.9	14.6	11.2	10.4	4.1	8.7	12.1	21.3
1330	3.7	4.3	3.9	5.1	5.7	4.5	6.9	7.5	4.9	4.0	5.1	5.4	6.5
1400	3.9	3.4	3.2	4.6	7.2	5.7	6.1	14.1	5.2	3.5	5.8	8.4	20.3
1430	4.7	5.3	3.4	6.9	7.2	9.4	8.6	8.6	7.2	4.5	7.9	8.1	8.6
1500	1.6	5.8	2.6	2.9	12.2	8.4	4.6	12.7	9.4	3.4	7.8	8.9	22.0
1/15													
1441	2.9	2.0	2.1	5.8	4.1	4.9	6.8	4.3	3.1	2.3	5.0	4.7	15.1
1500	2.0	2.1		3.6	3.5		3.9	4.0		2.0	3.5	4.0	0.0
1552	2.3	2.4		3.0	11.6		8.7	21.9	5.2	2.2	6.4	11.9	42.3
1622	1.7	1.8	2.2	2.1	2.5	3.3	5.5	4.0	2.9	1.9	2.7	4.1	5.8
1652	2.1	1.7	2.0	2.4	3.6	3.5	2.8	3.7	4.0	2.0	3.2	3.5	3.6
1722	2.0	2.4	1.9	2.7	4.3	6.1	5.0	3.4	5.0	2.1	4.4	4.5	6.2
1/16													
938	.3			.6			1.1			.1	.2	.4	.6
1008	2.9	2.2	2.1	5.1	5.5	7.2	5.3	3.9	6.8	2.4	5.9	5.3	9.0
1050	2.2	2.0	2.7	2.6	2.8	5.2	2.7	3.5	5.3	2.3	3.5	3.8	3.9
1120	1.8	1.9	2.5	2.2	4.5	6.9	2.6	6.4	7.3	2.0	4.5	5.4	6.0
1150	2.5	2.2	2.5	3.8	3.3	4.8	5.0	4.2	4.3	2.4	4.0	4.5	5.0
1220	2.7	3.7	2.4	4.1	4.1	4.7	4.4	5.1	3.8	3.0	4.3	4.4	4.6
1250	2.3	2.6	2.4	3.7	5.7	3.5	4.8	6.3	3.4	2.5	4.3	4.8	6.6
1320	2.2	2.4	2.5	2.5	4.8	5.2	5.6	9.5	5.5	2.4	4.2	6.8	9.1
1350	.3			.5			.9			.1	.1	.3	.5
1420	3.1	3.0	2.4	4.7	5.7	4.5	6.1	7.1	3.6	2.8	5.0	5.6	6.5
1520	1.7	1.3	1.6	3.2	3.5	3.5	4.4	4.7	2.9	1.5	3.4	4.0	4.2
1550	1.6	1.7	1.2	2.5	3.9	3.3	2.5	3.6	2.4	1.5	3.2	2.8	3.5
1620	1.6	1.7	2.5	3.3	2.9	4.2	4.4	4.3	3.5	1.9	3.4	4.1	4.9
1650	2.5	1.9	1.3	3.6	3.6	3.2	3.9	3.1	4.0	1.9	3.5	3.7	4.5
1720	1.3	1.6	1.5	1.5	3.4	2.2	1.5	2.6	2.2	1.4	2.4	2.1	3.3
1750	1.0	1.4	1.5	1.7	3.2	4.7	1.8	3.7	4.0	1.3	3.2	3.2	3.3
1820	1.6	1.6	1.9	2.1	2.8	3.5	3.5	3.1	2.0	1.7	2.8	2.9	4.3
1850	1.5	1.6	1.9	2.4	2.4	2.7	2.5	3.1	2.4	1.7	2.5	2.7	4.2
1929	2.1	3.3	2.6	3.5	4.2	5.0	6.8	4.5	7.5	2.7	4.2	6.3	6.7
1950	2.3	1.5	2.3	4.0	3.9	4.2	5.3	3.9	5.8	2.0	4.0	5.0	5.1
2020	2.3	5.0	28.6	3.4	7.0	54.9	6.1	7.0	87.8	11.7	21.8	33.6	76.5
2050	11.0	2.9	4.3	12.8	5.0	13.4	15.8	5.0	19.7	6.0	10.4	13.5	19.7
2120	2.0	1.8	1.6	3.3	2.8	3.2	8.9	2.7	2.7	1.8	3.1	4.8	7.8
2150	1.3	1.4	1.8	2.0	1.8	4.8	4.4	3.1	3.3	1.5	2.8	3.6	3.5
2220	1.3	1.4	1.0	1.8	1.9	3.5	2.6	3.2	2.6	1.3	2.4	2.8	4.5
2250	1.2	1.4	1.2	1.5	2.7	3.2	2.6	2.6	3.5	1.3	2.5	2.9	3.8

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
12/05													
1448	1.9			2.2			2.4						
12/06													
1116	2.8			5.1			8.4			.9	1.7	2.8	4.9
1146	1.7	1.1	1.8	1.9	1.5	1.8	2.6	1.[illegible]	2.2	1.5	1.8	2.1	2.6
12/07													
748	1.7	4.1		3.0	8.0		4.2	23.1	6.1	3.0	6.8	11.2	36.8
818	2.8	3.9	5.5	8.0	11.6	9.5	15.9	24 5	12.8	4.0	9.7	17.7	18.9
848	2.2	2.1	3.1	3.4	4.5	10.8	3.8	4.[illegible]	[illegible]7.9	2.5	6.2	8.8	13.3
12/08													
1109	1.2			1.9			2.1						
1119	1.3			2.4			3.1						
1129	.9			1.1			1.3						
1139	8.2			10.4			55.1						
1159	8.9			14.0			16.8						
1209	4.9			6.7			8.6						
1219	4.2			10.0			23.1						
1252	6.8	30.5	18.8	11.1	55.5	28.9	14.5	89.9	35.1	18.7	31.9	46.5	66.2
1322	5.2	3.2	3.4	7.7	3.9	5.6	10.3	5.1		4.0	5.7	7.7	9.0
1352	2.0	2.0	1.5	3.0	2.6	3.2	3.9	3.4	2.0	1.8	2.9	3.1	7.2
1422	2.6	2.6	2.3	3.5	4.6	4.2	4.1	5.4	7.2	2.5	4.1	5.6	9.1
1452	3.4	4.3	3.5	4.1	6.5	6.0	5.5	11.4	6.9	3.7	5.5	7.9	11.9
1522	2.8	2.4	2.7	3.3	3.1	3.7	3.9	4.4	3.7	2.6	3.4	4.0	4.0
1552	3.0	10.1	17.1	4.4	11.1	50.3	5.7	18.9	65.3	9.8	21.9	29.9	40.5
1622	31.7	7.5	5.0	32.5	11.9	9.9	48.5	10.3	10.2	15.1	18.1	23.0	31.3
1652	5.6	6.8	13.0	7.0	9.2	14.8	12.4	9.0	14.6	8.3	10.3	12.0	16.9
1722	21.4	32.0	30.8	23.9	39.5	39.5	49.2	45.0	63.7	27.9	34.3	52.6	53.2
1752	33.0	3.1	2.2	40.8	8.4	3.7	47.8	11.9	5.8	14.2	17.6	21.8	39.5
1822	2.4	3.7	5.2	4.5	4.1	10.4	12.4	5.8	13.7	3.7	6.3	10.6	17.1
1852	11.1	14.7	6.5	16.0	20.7		18.1	37.2		11.5	17.8	27.5	31.9
1922	3.8	2.7	2.5	3.7	3.3	4.1	4.6	3.4	3.1	3.0	3.7	3.7	5.6
1952	2.7	2.6	1.8	4.8	2.6	2.8	9.8	3.7	3.7	2.4	3.4	5.7	7.0
2022	2.0	1.7	1.5	3.2	2.3	2.0	4.4	4.3	2.0	1.7	2.5	3.6	4.1
2052	1.4	2.0	1.4	1.9	2.3	3.2	2.9	4.4	2.1	1.6	2.5	3.1	5.5
2122	3.5	2.4	2.8	4.7	3.1	5.4	11.2	3.0	6.3	2.9	4.4	6.8	12.9
2152	8.7	4.7	4.4	15.1	8.0	5.9	42.5	6.9	5.8	6.0	9.7	18.4	29.6
2222	4.8	4.3	4.6	8.4	5.4	6.6	22.6	8.2	6.1	4.6	6.8	12.3	21.1
2252	4.7	5.0	4.8	7.1	5.3	9.8	7.6	7.3	12.8	4.8	7.4	9.2	16.5
2322	9.1	11.2	6.0	10.5	14.7	10.6	17.9	16.4	11.5	8.9	11.9	15.9	20.1
2352	4.8	4.4	5.2	6.0	5.8	8.9	10.5	7.7	9.4	4.5	6.9	9.2	15.1
12/09													
22	4.9	2.8	3.7	8.1	5.1	5.5	14.6	6.6	7.6	3.8	5.2	9.6	15.3
52	3.2	4.0	4.5	8.5	7.0	9.8	10.2	6.8	8.2	3.9	8.4	8.4	11.3
122	3.8	13.1	38.4	4.9	18.9	64.4	6.5	33.3	73.8	17.6	29.4	37.9	50.9
152	8.9	9.7	6.6	9.0	13.2	10.6	10.8	12.9	10.3	8.5	10.9	11.4	16.1
222	7.3	29.2	9.3	12.8	32.5	36.3	28.4	48.5	35.3	15.5	27.2	37.4	61.9
252	8.3	8.0	10.7	12.3	12.0	12.4	14.2	17.4	14.1	8.9	12.3	15.3	16.5
322	9.8	10.8	7.7	17.0	17.0	11.2	37.2	33.1	10.9	9.5	15.1	27.1	34.5
352	5.4	6.7	8.7	5.6	10.3	20.6	8.0	11.6	21.0	6.8	12.2	13.5	16.0

WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period												
	1min Ave			3min Ave			10min Ave			1/2hr Period			
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
422	5.6	4.1	4.3	8.3	7.7	5.6	12.0	11.1	5.5	4.7	7.2	9.5	14.1
452	4.3	7.8	7.8	4.8	10.4	18.0	5.1	13.6	22.9	6.6	11.1	13.9	27.8
522	8.3	7.6	11.1	11.7	9.4	13.0	12.7	9.4	15.1	9.0	11.4	12.4	15.2
552	9.8	8.8	23.3	10.2	12.9	26.3	11.2	18.2	37.9	13.6	16.5	22.4	30.7
622	16.7	5.0	7.3	26.8	7.8	16.8	63.2	9.5	11.7	9.8	17.1	28.1	62.9
652	6.5	7.1	6.7	11.7	8.1	11.8	17.3	12.6	14.1	6.8	10.5	14.7	18.3
722	5.9	7.3	4.8	9.7	9.7	11.6	16.9	19.0	11.7	6.0	10.3	15.9	33.3
752	5.5	3.9	8.5	10.2	5.6	16.4	11.2	8.2	16.5	5.8	10.7	12.0	13.1
822	4.0	5.8	12.2	12.1	8.9	18.9	24.5	14.4	22.1	7.2	13.3	20.3	23.4
852	6.8	7.2	5.0	11.2	10.2	7.6	21.1	19.6	6.9	6.4	9.7	15.9	19.2
922	4.7	5.8	6.0	6.5	8.7	11.1	9.3	12.2	12.0	5.5	8.8	11.2	12.8
952	20.7	18.8	11.5	17.0	42.1	23.7	39.3	35.8	22.4	17.4	28.1	32.5	65.3
1022	28.6	8.3	7.1	45.3	9.6	18.3	61.4	12.6	19.3	14.9	24.4	31.1	43.8
1052	3.0	3.0	3.9	4.4	7.8	5.3	11.7	8.6	4.6	3.3	5.8	8.3	9.2
1122	4.2	2.2	2.8	6.4	2.8	4.3	9.0	3.3	5.5	3.1	4.5	5.9	7.6
1152	3.1	3.0	2.8	5.4	4.7	3.1	8.2	5.9	3.6	3.0	4.4	5.9	9.4
1222	3.3	4.6	3.2	5.6	6.8	7.2	9.9	10.4	5.6	3.7	6.5	8.6	12.3
1252	3.6	2.9	3.4	5.9	3.3	7.5	7.9	4.8	8.5	3.3	5.6	7.1	9.7
1322	2.0	2.1	2.3	2.7	4.0	5.9	5.2	5.5	5.5	2.1	4.2	5.4	9.7
1352	2.2	1.9	2.8	2.5	2.5	8.1	2.6	4.0	9.9	2.3	4.3	5.5	7.1
1422	3.0	1.4	1.9	4.1	2.3	4.1	7.5	2.6	3.6	2.1	3.5	4.6	7.8
1452	1.8	3.0	2.6	3.3	5.8	7.8	3.8	16.2	10.7	2.5	5.6	10.2	15.3
1522	9.8	16.3	3.8	14.5	28.3	9.8	34.1	45.0	16.5	10.2	17.5	31.9	41.8
1552	3.5	1.9	1.6	5.0	3.0	3.5	11.1	3.9	4.5	2.3	3.8	6.5	11.3
1622	1.2	1.5	1.8	2.8	3.4	3.6	5.8	6.0	3.4	1.5	3.3	5.1	6.1
1652	2.0	1.8	1.4	3.9	3.9	2.4	7.3	4.8	3.9	1.7	3.4	5.3	8.2
1722	1.4	1.1	1.1	1.9	2.0	2.1	2.8	2.9	3.2	1.2	2.0	3.0	7.6
1752	1.3	1.5	1.9	2.3	2.9	3.0	3.0	2.8	3.2	1.5	2.7	3.0	4.2
1822	2.9	2.5	2.3	3.5	2.9	4.2	6.0	2.6	4.4	2.6	3.5	4.3	8.3
1852	2.6	2.0	1.1	2.7	3.9	2.7	3.8	6.4	4.3	1.9	3.1	4.8	12.8
1922	1.1	1.2	2.7	2.6	1.8	5.3	6.2	1.7	7.5	1.6	3.2	5.2	5.4
1952	1.4	1.4	1.3	3.1	1.8	2.9	5.8	2.4	5.2	1.4	2.6	4.4	6.5
2022	2.7	7.5	7.4	2.9	8.1	9.8	5.3	12.0	8.7	5.8	7.0	9.7	19.1
2052	23.5	10.4	6.4	26.2	17.4	8.1	50.0	14.8	6.7	13.7	17.3	23.8	38.9
2122	3.1	7.6	1.9	6.3	4.7	5.6	13.3	7.5	10.0	2.5	5.5	10.3	13.1
2152	4.2	6.7	8.9	4.8	7.7	10.1	5.7	10.2	11.7	6.5	7.5	9.2	23.2
2222	3.8	3.8	4.3	4.8	3.9	6.2	5.0	7.0	9.0	4.0	5.0	7.0	9.2
2252	3.4	2.8	3.8	4.1	3.0	5.2	6.4	3.9	6.1	3.3	4.1	5.5	6.3
2322	3.7	5.9	8.1	5.0	7.1	9.3	7.5	7.1	13.5	5.8	7.2	9.4	9.6
2352	6.4	6.3	5.7	9.7	9.1	8.0	15.9	8.7	7.0	6.1	8.9	10.5	12.0
12/10													
22	4.5	5.6	5.2	5.2	6.9	8.5	8.9	9.8	8.5	5.1	6.9	9.1	14.4
52	2.9	4.2	2.5	3.5	4.8	4.8	4.0	4.7	4.0	3.2	4.4	4.2	4.3
122	2.4	2.9	3.1	2.9	3.2	4.3	3.4	6.5	5.1	2.8	3.5	5.0	9.3
152	4.7	5.7	2.7	5.7	7.5	3.6	6.2	10.7	4.4	4.5	5.6	7.1	14.8
222	3.1	3.3	3.2	3.5	3.4	5.7	5.0	5.1	9.2	3.2	4.2	5.4	6.6
252	6.3	5.5	36.4	7.1	6.1	39.2	7.0	5.8	48.2	15.3	17.5	20.3	27.1
322	7.5	5.5	5.4	7.9	7.0	11.3	9.1	8.4	17.7	6.2	8.7	11.7	28.3
352	8.2	3.9	4.6	9.2	6.0	6.3	13.8	9.2	6.0	5.6	7.2	9.7	11.0

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
422	4.8	6.4	4.7	5.7	9.9	4.9	8.3	17.3	5.2	5.3	6.8	10.2	22.5
452	4.6	5.3	2.5	6.2	8.7	3.3	9.2	18.4	4.1	4.2	6.0	10.6	25.7
522	3.1	2.1	2.0	4.4	2.7	5.5	7.7	5.0	7.0	2.5	4.2	6.6	9.1
552	2.6	1.8	.9	3.8	4.5	1.7	6.0	3.8	2.6	1.8	3.3	4.1	5.7
622	1.3	2.1	1.9	1.9	2.7	2.3	3.7	3.6	2.0	1.8	2.3	3.1	5.6
652	1.4	1.6	1.5	1.7	2.8	2.9	2.1	5.0	4.5	1.5	2.5	3.9	8.6
722	1.4	1.8	1.6	2.1	2.0	2.4	2.6	2.9	3.3	1.6	2.2	2.9	4.3
752	1.1	1.2	1.7	1.7	2.6	4.4	2.9	4.0	3.3	1.3	2.9	3.4	5.0
822	1.4	1.3	1.3	1.9	1.5	2.6	2.6	2.5	1.9	1.3	2.0	2.3	5.2
852	13.8	6.9	3.4	27.3	13.9	5.4	59.9	14.8		8.6	16.8	37.3	55.1
922	1.8	2.8	14.4	2.3	3.6	24.6	3.6	4.6	64.1	6.0	10.2	24.1	36.6
952	2.6	3.0	2.0	3.2	7.8	3.3	9.9	13.7	4.6	2.5	4.9	9.4	33.6
1022	2.0	2.1	2.4	2.5	3.1	4.9	3.4	3.2	5.7	2.2	3.5	4.1	7.5
1052	2.4	2.4	3.1	4.0	2.8	3.8	6.4	3.9	5.1	2.6	3.5	5.2	12.1
1122	2.0	1.5	1.7	3.3	2.2	2.6	6.3	4.1	3.2	1.7	2.7	4.5	6.0
1152	2.0	1.6	2.1	2.5	2.2	4.2	3.9	2.5	4.1	1.9	3.0	3.5	4.0
1222	5.5			6.2			6.5						
1252	6.0	8.6	9.4	10.0	11.1	11.1	14.5	17.7	12.4	8.0	10.7	14.9	15.5
1322	9.8	15.1	10.6	11.5	20.1	32.6	12.8	53.5	28.4	12.2	21.4	31.6	44.2
1352	17.4	4.5	4.5	18.9	6.5	4.4	31.7	7.7	5.1	9.0	9.9	14.8	20.4
1422	6.8	19.1	7.4	7.1	26.0	9.6	7.1	42.0	12.7	11.2	14.2	20.6	53.2
1452	1.8	2.1	3.2	3.0	2.9	4.4	5.8	3.1	6.0	2.3	3.5	5.0	7.8
1522	3.4	1.6	2.3	4.2	2.7	5.2	4.7	5.9	8.0	2.4	4.0	5.2	14.6
1552	2.1	1.8	1.4	2.8	2.0	3.0	5.0	3.6	4.8	1.8	2.6	4.5	5.6
1622	6.3	2.7	3.7	8.1	3.3	6.0	16.8	5.2	12.3	4.3	5.8	11.4	15.4
1652	2.9	4.8	11.7	5.3	6.7	19.4	7.9	8.1	33.5	6.3	10.4	16.4	22.7
1722	3.0	2.3	1.1	5.8	5.6	2.0	12.3	4.2	3.3	2.1	4.5	6.6	24.5
1946	2.3	2.8	2.2	2.4	3.7	3.2	2.7	5.0	4.4	2.5	3.1	4.0	5.1
2016	2.3	2.0	1.7	4.4	2.8	4.3	10.9	3.1	7.4	2.0	3.8	7.1	10.7
2046	1.9	2.4	2.6	2.9	2.7	6.6	5.7	4.3	4.3	2.3	4.1	4.8	9.6
2130	1.9	2.4	3.8	2.4	4.5	5.7	4.3	8.1	6.2	2.7	4.2	6.2	9.4
2200	2.2	3.4	5.0	4.5	6.5	8.4	6.4	5.8	7.4	3.5	5.5	6.5	8.8
2230	2.4	2.2	5.0	3.6	3.8	7.4	4.4	5.1	12.8	3.1	4.9	7.4	12.4
2300	6.7	2.4	3.4	7.3	4.0	6.9	9.4	8.7	5.8	4.2	6.7	8.0	10.3
2330	1.7	2.6	2.3	2.0	3.9	3.0	2.1	7.0	3.1	2.2	3.0	4.1	7.4
12/11													
0	1.9	1.4	2.0	2.7	2.1	2.9	8.7	2.1	3.3	1.7	2.6	4.7	8.3
30	1.4	1.9	1.8	1.7	2.4	3.7	2.7	2.4	3.2	1.7	2.6	2.7	3.5
100	2.5	3.8	3.9	2.5	6.7	5.8	2.7	15.4	5.6	3.4	5.0	7.9	18.1
130	5.0	2.6	1.5	6.4	4.1	2.7	10.4	7.1	3.5	3.1	4.4	7.0	12.5
200	2.5	3.8	2.4	3.6	4.3	8.2	8.6	5.1	8.6	3.0	5.3	7.4	15.6
230	3.9	2.1	1.9	4.9	4.7	3.1	11.2	4.3	2.3	2.6	4.2	6.0	7.2
300	2.1	2.6	2.1	3.4	3.2	3.3	6.1	5.3	3.5	2.3	3.3	5.0	12.4
330	2.6	1.8	2.4	3.2	1.9	3.2	4.0	2.4	3.2	2.3	2.8	3.2	6.5
400	3.0	3.6	4.9	4.2	3.5	5.0	7.6	4.2	5.0	3.8	4.2	5.6	7.1
430	3.4	7.6	9.8	11.4	15.6	14.6	15.4	16.1	28.1	8.9	13.9	20.2	22.6
500	2.5	2.2	2.6	2.6	3.0	4.4	4.2	4.3	5.7	2.4	3.3	4.7	11.0
530	2.2	2.6	1.6	2.7	6.3	4.3	3.9	6.9	6.6	2.2	4.4	5.8	10.7
600	1.3	1.7	1.9	2.0	2.5	3.4	2.1	3.1	2.9	1.7	2.6	2.7	2.8

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
630	2.5	2.2	1.8	3.5	3.1	2.5	3.7	4.1	4.2	2.2	3.0	4.0	4.6
700	1.7	2.3	1.4	2.2	2.6	3.4	2.4	3.3	4.0	1.8	2.7	3.2	3.4
730	2.0	1.5	1.8	3.5	3.1	3.9	4.5	4.4	4.4	1.8	3.5	4.4	8.8
800	3.7	6.9	3.1	4.5	10.4	6.5	6.7	12.6	6.1	4.7	7.2	8.5	14.9
830	7.4	5.6	4.6	8.0	7.3	6.9	8.4	7.5	5.3	5.9	7.4	7.1	13.7
900	4.0	6.1	7.2	6.0	8.2	10.3	7.6	8.4	9.6	5.7	8.2	8.5	9.0
930	5.3	4.9	3.9	9.2	6.9	10.9	16.7	8.4	6.4	4.7	9.0	10.5	24.5
1000	3.3	7.1	5.5	3.5	13.5	10.9	4.8	8.7	8.3	5.4	9.3	7.3	19.9
1030	4.6	4.4	9.1	5.1	4.6	9.5	5.8	6.2	12.9	6.0	6.4	8.3	10.0
1100	19.6	29.5	21.4	24.6	33.7	41.3	26.8	35.9	42.3	23.7	33.2	35.0	47.4
1130	8.0	5.9	5.5	10.4	7.4	6.6	12.0	8.5	6.5	6.5	8.1	9.0	12.6
1200	4.7	3.4	1.9	5.1	3.5	4.5	5.9	3.8	5.2	3.3	4.3	4.9	7.6
1230	2.4	3.1	3.3	3.1	9.3	14.0	4.1	19.6	13.8	2.9	8.8	12.5	18.3
1300	2.5	1.7	1.6	3.0	2.4	2.5	3.0	3.4	2.5	1.9	2.6	3.0	3.2
1330	2.0	1.9	1.8	2.3	2.0	3.7	3.5	3.0	3.3	1.9	2.7	3.3	3.8
1400	1.9	1.2	1.8	2.6	2.5	2.5	2.9	3.9	2.6	1.6	2.6	3.1	5.3
1430	1.8	1.2	1.6	1.9	1.9	2.9	2.2	2.2	2.3	1.7	2.2	2.2	2.4
1500	1.5	2.0	1.3	1.9	2.1	2.8	2.0	2.9	2.3	1.6	2.3	2.4	2.5
1530	1.5	1.4	1.9	2.1	2.0	2.2	4.2	2.3	2.0	1.6	2.1	2.9	3.5
1600	1.4	1.5	1.7	1.5	1.8	2.4	1.6	2.4	1.9	1.6	1.9	2.0	2.3
1630	1.6	1.9	1.9	1.9	2.1	2.2	2.0	2.4		1.8	2.0	2.2	2.5
1657	1.2	1.5	1.5	1.7	2.0	2.2	1.8	1.9		1.4	1.9	1.9	2.3
1724	1.7	1.2	1.6	2.0	1.8	1.6	2.0	1.6		1.5	1.8	1.8	2.5
1751	1.6	1.4	1.8	2.0	1.8	2.3	2.1	1.9		1.6	2.0	2.0	2.2
1818	1.9	1.7	1.9	2.3	2.1	2.2	2.5	2.5		1.8	2.2	2.5	2.7
1845	1.4	1.2	2.4	2.1	2.0	2.6	2.6	1.9		1.5	2.2	2.3	2.4
1912	2.0	1.8	2.6	3.4	2.2	3.9	4.6	2.5		2.0	3.1	3.5	4.7
1939	2.2	7.5	12.4	2.7	17.2	20.3	3.4	42.2		6.8	12.5	22.8	58.3
2006	1.8	2.4	1.9	3.1	3.5	4.9	3.6	3.5		2.1	3.7	3.6	4.4
12/12													
901	4.8	3.4	2.0	6.4	3.8	2.8	6.3	4.2	2.3	3.4	4.3	4.3	4.7
931	2.8	2.8	1.7	4.0	4.1	3.5	4.4	6.1	3.7	2.5	3.9	4.8	8.8
1001	4.9	1.6	2.4	13.4	2.7	6.5	28.7	3.6	6.9	3.0	7.5	13.1	37.7
12/13													
730	3.5	18.1		4.4	4.7		5.1						
801	10.7	12.6	35.7	13.7	14.1	42.3	14.7	20.4	42.2	18.9	23.4	25.8	27.6
831	13.5	11.1	9.3	12.7	12.8	12.6	15.0	11.8	14.3	11.3	12.7	13.7	13.7
900	7.7	5.7	2.9	8.3	6.8	5.8	10.2	8.8		5.6	7.1	9.5	12.7
929	2.1	2.3	1.4	2.9	2.7	4.8	3.0	2.9		2.0	3.3	2.9	4.1
1000	4.9	6.2	3.5	5.8	8.9	5.4	6.4	12.5	6.2	4.9	6.7	8.3	17.2
12/10													
1857	1.9	2.6	4.0	2.3	4.3	4.8	2.8	6.7	6.2	2.8	3.8	5.2	11.1
12/13													
1030	8.0	4.6	6.0	9.9	7.8	5.5	10.0	11.3	8.9	6.2	8.0	10.1	11.3
1130	5.7	18.8	2.8	7.3	25.2	5.6	9.7	55.0	6.0	9.3	12.7	23.6	76.4
1200	3.2	5.5	1.9	5.1	16.3	3.6	7.6	24.4	4.5	3.6	8.3	12.2	25.1
1230	2.7	4.2	3.2	3.7	5.4	4.7	5.0	8.6	4.7	3.3	4.6	6.1	6.8
1200	2.9	4.2		4.8	18.7		7.3	24.8	4.8	3.0	9.0	12.3	25.1
1230	2.6	3.3		3.6	6.5		4.6	8.6	4.6	3.5	5.3	6.0	6.8

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period												
	1min Ave			3min Ave			10min Ave			1/2hr Period			
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1300	2.6	1.6	1.4	3.0	2.8	3.0	4.5	4.4	3.0	1.9	3.0	4.0	6.2
1330	1.3	1.8	2.2	2.4	3.1	4.0	2.6	3.8	4.3	1.8	3.2	3.5	3.6
1400	1.7	1.9	2.3	3.8	3.5	4.2	3.8	3.5	4.7	1.9	3.8	4.0	4.0
1430	1.7	2.1	1.6	1.8	3.5	2.4	2.4	2.7	2.6	1.8	2.6	2.6	3.6
1500	1.5	1.2		2.3	1.6		2.5	2.1	2.5	1.4	2.1	2.4	2.4
1530	1.1	1.8		2.4	2.2		2.6	2.2	2.1	1.5	2.2	2.3	3.0
1600	1.2	1.4		1.4	2.2		2.0	2.3	1.9	1.3	2.1	2.0	2.4
1630	1.3	1.2	1.1	1.4	1.7	2.8	1.9	1.5	2.2	1.2	2.0	1.9	1.9
1700	1.5	1.6	1.8	1.5	2.3	2.4	1.6	2.7	2.7	1.6	2.0	2.3	2.7
1730	1.7	1.1	1.8	2.4	1.9	2.9	2.6	1.9	2.9	1.5	2.4	2.5	3.3
1800	.9	1.4	1.3	1.4	2.0	2.2	1.8	1.7	2.0	1.2	1.9	1.8	2.7
1830	1.1	1.4	1.3	1.4	2.6	2.4	2.5	3.9	2.5	1.3	2.1	2.9	5.6
1900	1.5	1.8	2.2	2.0	2.4	4.3	2.2	2.5	4.7	1.8	2.9	3.2	3.9
1930	1.8	1.9	3.1	2.2	3.3	4.5	3.0	3.9	5.2	2.3	3.4	4.0	4.6
2000	2.9	2.9	6.0	5.0	4.4	11.9	11.8	6.0	16.5	3.9	7.1	11.4	21.6
2030	11.6	18.7	7.2	15.0	34.9	17.9	22.8	45.9	20.1	12.7	22.6	29.6	51.5
2130	2.6	4.0		2.9	5.1		3.5	8.4		3.6	4.3	5.9	0.0
2200	5.2	3.7	5.8	5.3	6.6	11.8	7.0	7.1	8.0	4.9	7.9	7.3	10.7
2230	4.1	5.3	3.7	5.2	6.2	7.4	7.3	8.3	7.5	4.4	6.3	7.7	17.9
2300	2.7	3.4	4.1	4.7	4.9	7.8	7.4	5.2	7.9	3.4	5.8	6.8	18.5
2330	10.8	14.1	7.4	13.7	18.5		16.0	19.1		11.4	15.9	17.5	31.9
12/14													
0	5.6	6.7	8.7	6.8	9.1	15.8	7.2	8.7	13.0	7.0	10.6	9.6	25.1
29	8.1	6.7	7.3	8.9	9.4	14.0	9.8	11.2	10.2	7.3	10.4	10.4	16.7
58	4.9	5.5	7.3	5.8	6.7	9.6	6.4	9.2	10.9	5.8	7.1	9.8	17.6
127	4.0	5.0	3.9	5.2	5.4	7.2	5.9	5.9	8.9	4.3	5.8	6.9	8.2
156	3.5	3.2	2.6	3.6	3.6	3.0	3.8	4.0	2.6	3.1	3.5	3.5	3.8
225	2.3	2.5	2.4	2.5	3.4	3.1	4.6	3.0	3.7	2.4	3.0	3.8	5.6
254	2.9	2.6	1.7	3.5	2.6	9.3	4.3	4.6	9.0	2.5	4.6	6.0	12.7
323	2.8	2.6	2.8	5.1	4.6	4.7	8.4	4.6	3.7	2.7	4.8	5.6	14.5
352	2.9	1.5	1.5	4.7	2.7	3.2	8.9	2.9	3.3	2.0	3.6	5.0	6.4
421	1.8	2.0	2.1	2.8	3.6	3.7	4.6	5.7	3.0	2.0	3.3	4.5	8.2
450	1.5	2.6	4.9	3.0	5.4	21.4	4.2	15.9	19.1	2.9	8.3	13.0	39.2
519	3.8	3.3	4.5	5.0	5.1	6.4	4.9	5.3		3.8	5.4	5.1	7.1
548	2.9	4.6	11.7	5.1	9.8	18.1	7.0	15.2	20.4	6.2	10.1	14.2	26.2
617	8.7	5.4	8.7	11.6	13.2	15.4	33.9	17.6	16.6	7.5	13.1	22.7	35.9
646	11.6	15.7	24.5	15.9	25.1	11.7	24.5	35.4		16.7	18.3	29.9	42.4
728	8.3	4.7		11.9	15.1		13.4	16.6		6.4	13.5	15.0	0.0
800	2.8	4.0	2.8	3.7	5.4	5.3	8.2	5.8	4.8	3.2	4.8	6.3	6.6
830	4.5	3.9	3.3	4.3	3.9	9.2	6.0	4.0	9.9	3.9	6.0	6.6	7.1
900	4.4	6.9	5.0	5.0	15.7	7.1	9.0	16.8	7.7	5.5	9.2	11.2	20.0
930	6.4	4.1	3.7	7.6	5.3	8.1	9.2	6.4	9.2	4.7	7.0	8.3	11.7
1000	3.4	4.7	3.1	5.0	7.7	5.7	8.8	12.6	5.5	3.9	6.1	9.0	10.1
1030	2.6	2.1	4.4	4.9	6.9	21.2	7.4	11.0	29.8	3.0	10.9	16.1	25.0
1100	6.7	1.6	1.3	19.0	2.0	3.0	22.8	2.3	2.0	3.2	8.0	9.1	14.1
1130	1.5	1.4	1.1	2.4	2.1	1.9	3.1	3.4	2.4	1.3	2.1	3.0	3.1
1200	1.5	1.1	1.2	2.5	1.8	2.9	3.3	2.0	2.4	1.3	2.4	2.5	2.7
1230	1.1	1.7	1.3	1.3	2.9	2.3	1.3	2.9	2.6	1.3	2.2	2.3	2.4
1300	1.7	1.6	1.6	2.4	1.9	1.9	2.4	2.5	1.8	1.6	2.1	2.2	2.3

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1330	1.4	1.6	1.3	1.4	2.4	2.4	1.7	2.1	1.9	1.4	2.1	1.9	2.1
1400	1.4	1.6	1.7	1.5	1.8	2.2	1.8	2.0	2.4	1.6	1.8	2.1	2.1
1430	1.4	2.0	2.0	1.5	2.2	2.2	1.8	2.5	2.1	1.8	2.0	2.1	2.2
1500	1.5	1.5		2.1	1.8		2.1	2.0	2.3	1.4	2.2	2.1	2.2
1530	1.6	1.6		1.5	1.7		1.6	1.9	1.7	1.4	1.7	1.8	1.8
2300	2.5	2.0	2.0	3.2	2.8	4.2	3.3	2.5	3.6	2.2	3.4	3.1	5.2
2330	1.8	1.8	2.1	2.6	1.9	2.9	3.2	2.0	3.2	1.9	2.5	2.8	3.7
12/15													
0	1.4	2.8	5.7	1.8	4.2	19.9	3.3	8.7	36.3	3.2	8.6	16.1	41.9
30	2.8	1.7	1.9	4.0	2.9	4.1	4.6	3.0	4.1	2.2	3.6	3.9	8.4
100	1.8	2.0	1.8	1.9	3.0	2.6	2.2	3.6	2.4	1.9	2.5	2.7	2.9
130	2.1	2.3	1.9	2.5	2.7	2.3	3.7	2.9	2.4	2.1	2.5	3.0	5.6
200	2.2	1.7	2.8	2.2	1.9	2.9	3.4	2.0	3.8	2.2	2.3	3.0	5.5
230	2.5	2.0	2.5	3.4	2.6	3.2	3.9	2.8	2.9	2.3	3.1	3.2	3.2
300	2.7	2.8	3.1	3.5	3.6	3.6	4.6	4.4	3.4	2.9	3.6	4.2	5.4
330	2.4	4.3	3.3	3.4	4.7	4.4	5.8	4.9	4.1	3.3	4.2	4.9	5.2
400	2.5	2.6	6.9	2.7	3.9	10.9	4.4	3.9	11.3	3.9	5.8	6.6	7.4
430	6.8	10.5	19.5	9.1	17.3	34.2	13.6	39.5	30.3	12.0	20.2	27.8	59.0
500	6.0	3.5	4.2	7.1	7.8	6.4	7.6	13.5	7.5	4.6	7.1	9.5	12.9
530	5.5	4.6	3.0	6.1	6.2	3.7	8.5	9.2	3.3	4.4	5.3	7.0	10.5
600	3.1	2.7	2.4	4.1	3.0	3.5	5.0	3.2	4.7	2.8	3.5	4.3	5.2
630	2.3	2.8	5.4	2.7	4.4	14.4	7.6	9.3	15.5	3.4	7.2	10.8	22.0
700	5.8	5.7	5.3	9.1	9.1	8.5	12.1	14.2	11.4	5.6	8.9	12.6	24.6
730	4.3	3.3	3.3	5.0	3.8	4.3	9.4	7.5	4.7	3.8	4.4	7.2	12.2
800	14.4	1.8	3.1	27.9	3.9	4.7	69.1	9.3	6.8	6.7	13.1	28.4	56.4
930	2.4	1.3	1.9	3.4	1.7	2.6	5.2	2.9	3.6	1.9	2.6	3.9	4.0
1007	8.1	5.5	8.6	8.6	6.1	23.9	10.6	10.6	31.4	7.4	12.9	17.5	44.3
1028	7.3	5.0		8.4	5.9		10.6	6.3		6.2	7.2	8.5	0.0
1048	4.6	5.0		6.1	7.4		6.7	13.3		4.8	6.8	10.0	0.0
1108	6.7	2.3		10.6	6.0		18.4	8.5		4.6	8.3	13.4	0.0
1128	2.7	2.1		2.7	2.8		3.2	3.5		2.4	2.8	3.3	0.0
1148	2.4	2.6		2.6	2.9		3.0	3.9		2.5	2.8	3.5	0.0
1208	2.2	1.9		2.3	2.7		3.4	7.7		2.0	2.5	5.6	0.0
1229	5.2	8.2		6.4	9.7		9.0	9.9		6.6	8.0	9.5	0.0
1248	2.0	2.1		2.2	2.5		2.9	3.0		2.1	2.4	2.9	0.0
1308	2.1	2.3		2.6	2.6		2.6	3.8		2.2	2.6	3.2	0.0
1328	2.0	1.8		2.6	2.9		3.8	4.4		1.9	2.7	4.1	0.0
1348	3.2	2.0		7.3	2.5		22.5	3.5		2.7	4.9	13.0	0.0
1408	2.0	1.9		4.3	2.7		7.6	3.0		2.0	3.5	5.3	0.0
1429	6.3	8.3		7.0	9.2		7.0	9.3		7.3	8.1	8.2	0.0
1448	4.1	2.6		5.3	5.0		6.4	7.1		3.4	5.2	6.7	0.0
1530	1.5	1.2	1.3	2.0	1.9	2.0	2.5	3.3	2.1	1.4	2.0	2.6	4.1
1600	1.6	1.8	1.8	2.1	2.9	2.4	4.0	4.2	3.5	1.7	2.5	3.9	5.5
1630	1.8	1.6	1.6	2.5	1.9	3.0	2.7	2.2	3.1	1.7	2.5	2.7	2.8
1700	1.2	1.6	1.5	1.5	2.0	1.8	1.7	2.0	1.9	1.4	1.8	1.9	2.0
1730	1.5	1.7	1.6	2.3	2.0	2.5	2.5	2.3	2.2	1.6	2.3	2.3	4.1
1800	1.9	2.1	2.9	2.5	2.9	5.3	3.0	5.3	6.5	2.3	3.6	4.9	5.0
1830	9.7	6.8	26.3	17.5	11.6	43.3	32.4	11.4	68.0	13.8	24.1	37.2	46.1
1900	7.7	3.9	2.4	11.5	5.1	6.7	18.6	6.0	5.1	4.8	7.9	9.9	15.9

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1930	1.4	1.0	1.3	1.8	1.6	3.0	3.3	2.6	2.9	1.3	2.0	3.0	10.0
2000	1.1	2.0	2.2	1.6	2.0	3.3	1.9	3.2	6.5	1.7	2.2	3.9	5.6
2300	1.6	1.4	1.0	2.6	2.3	2.1	2.8	2.3	1.9	1.3	2.3	2.3	2.7
2330	.9	1.4	1.1	2.5	1.8	2.3	2.7	2.2	2.5	1.1	2.2	2.5	2.9
12/16													
0	1.4	1.1	.9	1.9	2.1	1.1	3.1	2.6	1.4	1.1	1.8	2.4	2.7
30	1.4	1.9	2.4	2.6	2.6	4.4	3.5	3.2	4.1	1.9	3.2	3.6	6.6
100	3.0	3.5	4.1	5.2	4.1	10.0	11.8	6.0	9.3	3.5	6.0	9.0	18.8
130	3.2	2.2	2.0	3.2	4.6	2.7	3.4	7.6	3.0	2.5	3.5	4.6	9.3
200	1.7	1.3	2.3	1.6	2.4	3.0	2.4	3.2	4.2	1.7	2.3	3.2	3.6
230	3.1	3.2	2.2	4.1	5.0	3.7	4.7	5.4	3.6	2.9	4.3	4.6	6.5
251	1.9	3.5		3.3	3.5		3.8	6.1		2.7	3.4	4.9	0.0
313	6.7			14.8			19.3						
326	3.0			5.9			10.1						
401	6.6	6.4		8.3	7.4		14.8	8.0		6.5	7.8	11.4	0.0
421	5.4	6.9		6.3	6.5		8.1	7.7		6.1	6.4	7.9	0.0
441	4.0	4.8		6.7	6.6		8.0	6.3		4.4	6.7	7.1	0.0
12/14													
1559	1.2	2.5		1.5	1.7		1.7						
1612	1.4	3.4		1.7			1.8						
1625	1.4	4.0		1.5	2.0		2.2						
1638	1.1	4.1		1.2	2.3		1.7						
1651	1.4	3.2		1.6	2.1		2.8						
1704	1.2	3.6		1.8	2.1		1.7						
1717	1.3	3.6		1.4	1.9		1.9						
1730	1.3	2.9		1.9	1.2		2.0						
1743	1.3	1.8		1.8	.9		2.3						
1756	1.2	3.7		1.3	2.3		2.5						
1809	1.3	2.1		1.8	1.6		2.3						
1822	1.5	10.8		1.6	12.9		2.4						
1835	3.6	3.6		7.1	1.6		19.7						
1848	1.3	3.2		1.6	2.3		2.1						
1929	1.7	1.6	1.3	1.9	2.0	2.5	2.0	2.3		1.5	2.0	2.1	2.1
1958	1.6	1.2		2.4	1.6		3.0	1.5		1.3	2.0	2.3	2.5
2030	2.1	1.9	2.2	2.6	2.3	2.4	2.9	2.6	2.3	2.1	2.4	2.6	2.7
2100	1.6	1.9	1.5	1.8	2.1	2.4	1.9	2.2	1.9	1.7	2.1	2.0	2.0
12/16													
501	3.7	2.2		4.3	3.7		6.4	7.6		3.1	4.1	7.0	0.0
521	4.5	2.8		8.8	3.1		12.2	3.8		3.7	6.0	9.0	0.0
541	2.4	2.6		2.8	4.5		3.5	7.9		2.5	3.6	5.7	0.0
601	2.5	4.1		2.7	8.2		3.5	10.1		3.3	5.5	6.8	0.0
621	2.8	2.0		3.3	2.9		4.7	3.8		2.4	3.1	4.2	0.0
641	1.7	1.8		2.3	2.6		2.4	2.5		1.7	2.4	2.5	0.0
701	2.0	1.6		2.4	1.6		2.8	2.9		1.8	2.1	2.8	0.0
721	1.6	1.3		1.7	1.5		2.0	1.7		1.4	1.6	1.9	0.0
741	5.1	1.7		9.3	2.5		13.5	3.1		3.5	5.9	8.3	0.0
801	2.0	2.2		2.1	2.6		2.2	2.8		2.1	2.3	2.5	0.0
821	3.2	1.7		3.9	9.5		8.5	19.3		2.5	6.7	13.9	0.0
841	1.4	1.8		1.9	3.0		2.1	3.0		1.5	2.5	2.5	0.0

BLM-3 WIND DIRCTION STANDARD DEVIATION (deg)

	|----------------10min Period							----------------|				
	1min Ave			3min Ave			10min Ave			1/2hr Period			
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
901	1.7	1.9		2.2	3.3		2.4	2.9		1.8	2.8	2.6	0.0
921	2.1	2.3		3.7	3.2		4.3	4.8		2.2	3.4	4.5	0.0
941	1.9	1.7		2.0	2.0		3.6	1.9		1.8	2.0	2.7	0.0
1001	1.2	1.4		1.7	1.6		2.0	2.3		1.3	1.6	2.2	0.0
1021	1.6	1.4		2.1	2.3		2.9	4.4		1.5	2.2	3.6	0.0
1041	2.3	2.6		3.2	5.3		7.9	6.0		2.4	4.3	6.9	0.0
1101	1.3	1.0		1.8	1.7		2.6	2.0		1.2	1.8	2.3	0.0
1129	1.4	4.3		2.0	1.1		3.4						
1144	1.0	3.3		1.7	1.6		2.6						
1159	2.8	6.6		2.9	3.9		4.1						
1214	2.8	6.5		4.3	3.1		5.7						
1229	2.1	6.4		2.6	2.8		5.2						
1244	1.6	5.9		3.3	1.9		5.0						
1259	1.4	2.1		2.1	1.5		2.3						
1314	1.6	3.8		2.0	1.9		5.2						
1329	1.6	3.4		2.2	1.2		3.4						
1400	1.6	1.5	1.4	2.2	1.7	1.4	2.1	1.5	1.8	1.5	1.8	1.8	2.3
1430	1.2	1.4	1.2	1.3	1.8	1.5	1.5	2.5	1.5	1.3	1.5	1.8	3.0
1500	1.4	1.7	1.2	1.5	1.8	1.4	2.4	2.7	1.8	1.4	1.6	2.3	4.3
1530	1.5	1.8	1.3	1.4	2.2	2.7	1.8	2.6	3.1	1.5	2.1	2.5	3.7
1600	1.3	1.3	1.8	1.5	1.5	1.9	2.1	3.5	2.4	1.5	1.6	2.7	4.1
1700	1.6	2.0	2.3	1.9	2.4	2.6	1.9	2.9	2.5	2.0	2.3	2.4	3.1
1730	2.0	1.8	1.8	2.2	2.3	2.1	2.5	2.5	2.0	1.8	2.2	2.4	2.5
1800	1.8	1.9	1.2	2.1	2.2	1.8	2.1	2.9	2.3	1.7	2.1	2.5	4.6
1830	1.8	2.3	1.7	2.1	2.8	3.2	2.6	4.4	3.8	1.9	2.7	3.6	5.7
1900	1.2	1.1	1.4	1.2	1.3	2.5	1.3	1.5	3.0	1.2	1.5	2.0	4.2
1930	1.6	2.2	2.1	2.9	3.7	2.4	8.5	4.9	2.7	2.0	3.0	5.4	7.5
2000	2.2	1.8	2.3	3.5	2.9	3.8	3.9	3.4	2.9	2.0	3.4	3.4	3.7
2030	2.4	1.4	1.7	6.1	1.7	2.7	10.6	1.9	3.7	1.9	3.5	5.4	6.7
12/17													
830	5.1			11.4			30.8			1.8	3.8	10.3	21.6
900	5.2			10.3			17.7			1.9	3.9	5.9	10.7
930	3.6	3.4	4.3	6.1	5.0	4.8	9.4	5.2	5.6	3.7	5.3	6.7	9.9
1000	3.3	5.0		3.6	15.6		4.8	42.5		2.9	6.4	15.8	41.4
1030	5.9			10.5			38.5			2.0	3.5	12.8	25.0
1100	3.5	3.4	3.2	3.5	4.7	3.5	5.3	5.5	3.8	3.4	3.9	4.8	8.2
1130	5.8			18.1			33.3			2.0	6.0	11.1	20.1
1200	4.2	7.1		4.6	16.1		6.6	62.7		3.9	6.9	23.1	61.5
1230	6.9	6.3		8.1	14.8		12.0	36.7		4.5	7.6	16.2	42.9
1300	3.3	3.7	2.8	5.3	4.4	7.8	8.7	7.6	16.8	3.3	5.8	11.1	14.6
1330	1.8			3.2			5.4			.6	1.1	1.8	3.2
1400	3.0			5.4			8.9			1.0	1.8	3.0	5.3
1430	3.8			6.9			11.5			1.3	2.3	3.8	6.8
1500	2.6	6.1		2.8	15.7		5.4	35.3		3.0	6.2	13.6	40.1
1530	1.9	2.5	10.8	2.2	3.4	9.9	2.3	3.7	18.9	4.8	5.2	8.3	15.2
1600	10.4			25.4			52.3			3.6	8.5	17.4	56.7
1630	6.5			15.4			31.8			2.3	5.1	10.6	42.4
1700	6.0			20.0			45.4			2.2	7.5	15.1	46.2
1730	6.5			21.9			63.6			2.3	7.3	21.2	46.6

BLM-3 WIND CIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1800	16.0	9.7	8.3	31.1	18.8	28.0	56.9	31.3	51.8	11.5	26.0	46.7	58.2
1830	6.8			15.9			28.3			2.4	5.3	9.4	16.9
1900	3.9	8.8		4.2	18.7		5.4	75.7		4.4	7.7	27.0	80.9
1930	4.0	9.6	7.3	7.4	4.0	47.7	14.9	26.5	54.7	7.0	19.7	32.0	44.4
2000	3.9	12.8	5.2	6.2	11.8	13.0	15.0	13.1	11.6	7.4	10.3	13.2	15.3
2030	3.6	5.0	1.8	7.2	8.9	8.8	19.3	15.7	12.2	3.5	8.3	15.8	20.9
2100	1.6	1.0	.9	2.2	1.5	2.1	5.3	3.1	2.5	1.2	2.0	3.6	4.7
2130	.9	.9	1.1	1.0	1.4	2.0	1.6	1.8	1.5	1.0	1.4	1.8	2.6
2200	.7	.7	1.0	1.0	1.4	2.1	1.0	1.9	2.2	.8	1.5	1.7	2.8
2230	.8	.8	1.0	.9	1.1	1.7	1.3	1.5	2.2	.8	1.3	1.7	1.8
2300	1.1	1.2	1.1	1.3	1.6	2.4	1.6	1.9	2.8	1.1	1.8	2.1	5.1
2330	1.5	1.6	2.4	2.9	2.0	4.2	3.2	2.8	3.4	1.8	3.0	3.1	4.9
12/18													
0	1.8	1.5	2.3	2.8	2.2	3.0	3.2	2.3	3.3	1.9	2.7	2.9	4.1
30	2.3	2.0	1.9	2.2	3.3	2.9	3.3	3.1	3.3	2.1	2.8	3.2	4.1
100	1.9	1.5	1.6	2.4	2.8	2.0	2.5	2.8	2.4	1.7	2.4	2.6	2.9
130	1.6	1.6	2.4	2.0	4.3	5.1	2.1	7.6	7.4	1.8	3.8	5.7	9.3
200	2.4	2.4	1.9	3.5	4.3	2.8	3.6	6.2	4.0	2.2	3.5	4.6	6.0
230	2.1	2.8	1.4	2.8	4.8	2.8	3.1	4.6	2.4	2.1	3.5	3.4	3.6
300	2.2	1.8	2.7	2.5	2.5	4.4	4.6	4.1	4.7	2.2	3.1	4.5	5.8
330	4.0	.8		5.2	28.6		6.6	51.5		1.7	11.3	19.4	71.3
400	2.2	2.9	2.6	2.6	3.3	4.1	3.5	4.1	3.5	2.6	3.3	3.7	3.9
430	2.4	2.1	2.0	2.9	2.4	3.1	4.3	3.5	3.3	2.2	2.8	3.7	7.0
500	2.5	10.5		3.8	30.8		6.1	78.5		4.7	13.0	28.2	81.6
530	8.8			30.4			61.0			3.0	10.1	20.3	37.5
630	10.8			21.6			37.1			3.8	7.2	12.4	22.1
700	2.5	2.4	2.6	4.2	5.7	5.8	4.5	11.8	7.9	2.5	5.2	8.1	22.1

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
6/20													
1851	6.9			12.7			21.4						
1902	74.0			41.0			0.0						
1957	4.2			6.9			12.0						
2030	36.5			20.3			0.0						
2214	2.0	3.8		2.5	12.0		3.5	25.4		2.1	5.4	9.6	25.8
2300	3.6			8.1			29.3						
6/21													
0	4.7	2.8	2.2	5.3	4.1	3.5	5.2	5.3	4.9	3.3	4.3	5.2	9.4
30	.5			11.9			31.9			.2	5.1	16.0	21.9
100	1.7	1.3	2.0	2.0	2.4	2.8	2.5	3.6	3.3	1.6	2.4	3.2	4.3
130	4.6			8.2			13.7			1.6	2.7	4.6	8.1
200	1.0	1.4	2.6	1.6	1.8	5.0	3.3	1.8	8.0	1.6	2.8	4.3	7.8
230	3.8	1.4	1.2	5.3	3.5	3.0	7.0	6.1	1.8	2.2	4.0	5.0	8.4
300	.7	1.0	.9	.9	1.7	1.7	1.3	1.6	2.4	.9	1.4	1.8	2.3
330	1.4	.9	.8	2.0	2.0	2.1	3.1	2.4	2.1	1.0	2.0	2.5	4.0
400	1.4	.7	.8	1.8	1.2	1.2	2.3	1.7	1.6	.9	1.4	1.8	2.3
430	1.0	1.3	.7	1.9	2.0	1.4	2.8	2.4	1.3	1.0	1.7	2.1	2.9
500	1.4	3.3	3.0	2.1	7.3	7.5	4.1	8.8	8.1	2.6	5.6	7.0	19.7
530	2.6	4.3	8.2	2.2	6.4	11.2	3.2	8.4	14.4	4.9	6.6	8.7	12.1
600	17.7	6.5	2.1	25.7	13.4	5.0	40.3	10.4	5.4	9.8	14.7	18.7	30.0
630	2.4	1.8	1.1	5.1	3.6	1.7	14.8	7.3	1.6	1.8	3.4	7.9	22.9
700	1.6	2.0	1.2	2.1	2.4	3.6	2.7	3.5	4.8	1.7	2.7	3.6	5.0
730	1.7	1.9	.8	2.5	3.1	2.2	3.2	4.1	3.6	1.5	2.6	3.6	4.0
800	.6	1.0	5.3	.7	1.2	20.4	1.2	1.7	39.8	2.2	7.4	14.2	24.4
830	5.2	2.1	4.5	14.6	2.9	6.9	34.0	5.2	13.8	3.9	8.2	17.7	30.8
935	1.6	3.5	1.9	3.1	10.0	4.9	7.2	12.3	8.4	2.3	6.0	9.3	13.7
1030	1.4	1.1	1.4	2.0	1.9	1.9	3.8	2.0	2.0	1.3	2.0	2.6	2.8
1100	.9	2.2	2.2	1.4	3.9	4.3	1.7	6.4	5.7	1.8	3.2	4.6	6.7
1130	1.9	2.6	2.7	2.0	5.5	3.7	2.7	5.9	4.1	2.4	3.7	4.2	4.8
1200	2.4	3.4	2.2	3.3	4.7	3.1	3.7	7.8	3.3	2.7	3.7	4.9	9.2
1300	2.9	2.1	1.3	3.0	2.5	1.7	3.3	3.3	1.8	2.1	2.4	2.8	3.0
1330	1.7	1.6	1.9	1.7	1.8	2.2	2.2	2.4	2.7	1.7	1.9	2.4	2.8
1400	1.5	1.4	1.4	1.9	2.2	2.4	3.4	2.7	2.1	1.4	2.2	2.7	3.4
1430	1.3	1.3	1.4	1.9	1.8	2.8	2.2	2.4	2.7	1.3	2.2	2.5	2.9
1500	1.5	1.2	1.2	1.8	1.8	2.3	2.9	2.5	2.4	1.3	1.9	2.6	3.1
1530	.9	1.3	1.2	1.5	1.8	1.6	1.7	2.3	1.9	1.1	1.6	2.0	2.0
1600	1.4	.9	.9	1.9	1.4	2.4	2.9	1.6	2.3	1.1	1.9	2.3	4.1
1630	.7	1.0	1.2	.9	1.5	1.3	2.1	3.0	1.6	1.0	1.2	2.2	4.8
1700	1.2	1.0	1.1	1.4	1.7	1.6	2.0	1.9	1.3	1.1	1.6	1.7	2.8
1730	1.0	1.0	.9	1.1	1.4	1.8	1.1	1.4	1.7	1.0	1.4	1.4	3.2
1800	.9			1.4			2.9						
1830	1.5	1.9	2.7	1.8	3.6	5.1	2.0	7.5	7.5	2.0	3.5	5.7	10.7
2030	1.6	1.2	.9	1.8	1.7	1.4	2.1	1.7	1.5	1.2	1.6	1.8	2.4
2100	1.3	1.2	1.0	1.5	1.4	1.6	2.5	1.3	2.1	1.2	1.5	2.0	2.2
2130	.8	.8	1.2	1.2	1.1	1.4	2.3	1.5	1.5	.9	1.2	1.8	2.2
2200	1.2	1.5	1.1	2.0	1.8	2.4	2.4	2.0	2.1	1.3	2.1	2.2	2.7
2230	.8	.8	1.0	1.2	1.9	2.2	1.4	3.3	2.7	.8	1.8	2.5	2.9
2300	.9	1.2	1.1	1.4	1.8	2.0	2.3	1.7	1.5	1.1	1.7	1.8	2.8

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	|----------------10min Period----------------								|				
	1min Ave			3min Ave			10min Ave			1/2hr Period			
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
2330	1.1	1.1	1.0	1.4	1.8	1.5	1.5	2.7	1.9	1.1	1.6	2.1	2.9
6/22													
0	1.2	.8	.7	1.2	1.2	1.3	1.6	1.6	1.2	.9	1.3	1.4	2.9
30	1.1	.9	1.2	1.4	1.2	1.7	2.8	1.8	2.7	1.0	1.4	2.4	5.9
100	1.5	1.3	1.1	1.8	2.0	2.6	2.0	2.3	4.6	1.3	2.1	3.0	3.8
130	1.6	2.7	3.5	2.0	3.1	7.3	2.0	4.6	7.3	2.6	4.1	4.6	5.7
200	2.1	2.2	2.1	3.2	3.6	5.1	4.5	4.2	4.5	2.1	3.9	4.4	10.0
230	5.0	4.8	4.6	7.8	7.2	6.5	18.0	9.3	5.6	4.8	7.2	11.0	14.6
300	2.8	1.2	1.6	4.3	3.4	1.9	7.9	4.7	3.0	1.9	3.2	5.2	7.9
330	1.7	1.6	1.7	1.9	1.9	3.2	3.5	2.3	3.6	1.7	2.3	3.1	3.5
400	2.1	1.6	1.7	2.7	2.9	3.6	6.6	2.9	3.8	1.8	3.0	4.4	5.6
430	2.4	1.6	1.8	4.2	2.8	3.0	5.7	2.1	2.4	1.9	3.3	3.4	9.3
500	1.5	1.3	1.5	2.0	2.5	2.4	6.5	2.5	2.9	1.4	2.3	4.0	5.3
530	1.4	1.3	1.0	1.9	2.0	2.2	2.2	3.4	3.3	1.2	2.0	3.0	7.3
600	1.7	1.3	1.2	1.9	1.5	1.8	2.4	1.5	1.9	1.4	1.7	2.0	2.5
630	1.1	1.3	2.2	1.3	2.1	3.4	4.0	2.3	3.3	1.5	2.3	3.2	5.2
700	1.6	1.9	2.2	3.7	3.3	2.5	7.2	4.8	2.5	1.9	3.2	4.8	5.8
800	3.6	3.2	2.8	5.7	5.4	6.2	8.4	6.0	4.8	3.2	5.7	6.4	13.4
830	5.2	3.6	5.8	10.7	4.6	6.4	12.6	5.7	7.2	4.8	7.2	8.5	11.8
900	10.9	9.8	7.7	19.7	14.3	16.4	25.4	33.4	20.7	9.2	16.8	26.5	37.6
930	5.0	4.1	6.1	8.8	4.9	8.3	27.9	6.4	9.6	5.0	7.3	14.6	26.5
1000	5.2	5.7	4.2	7.1	8.8	8.4	8.5	8.9	7.6	5.0	8.1	8.3	9.0
1030	3.2	2.1	2.3	5.5	3.5	4.7	7.6	6.2	4.4	2.6	4.5	6.0	7.4
1100	1.4	1.5	2.1	2.2	2.6	3.2	3.5	2.5	4.5	1.7	2.7	3.5	3.7
1200	4.2	7.3	2.4	5.6	10.8	4.2	8.1	13.0	5.1	4.8	6.9	8.7	11.1
1230	5.7	3.2	3.3	7.3	6.2	4.3	9.8	8.0	6.5	4.1	6.0	8.1	8.5
1300	2.5	2.7	2.3	2.5	3.3	3.4	5.7	4.1	3.3	2.5	3.1	4.3	5.9
1400	8.0	.9	1.1	13.5	2.0	2.0	20.5	2.7	2.7	3.4	5.8	8.6	12.4
1430	1.2	1.2	1.3	1.7	2.1	2.4	2.0	4.0	3.2	1.3	2.1	3.0	5.5
1500	1.4	1.3	1.3	2.0	1.9	2.0	2.5	2.9	2.0	1.3	1.9	2.5	4.1
1530	1.4	1.3	1.1	2.0	2.0	1.7	2.6	2.1	1.7	1.3	1.9	2.1	2.4
1600	1.4	1.1	1.0	1.9	1.7	1.9	2.2	2.1	1.8	1.2	1.8	2.0	2.5
1630	1.0	1.9	2.0	1.1	3.1	2.6	1.9	4.4	2.5	1.6	2.3	2.9	3.6
1700	2.4	2.0	1.9	3.2	3.8	2.9	3.2	5.4	5.1	2.1	3.3	4.6	4.6
1730	1.4	1.1	1.4	1.6	1.7	2.3	1.9	2.6	2.1	1.3	1.9	2.2	2.3
1800	1.3	2.0	2.6	1.8	3.4	4.2	1.9	3.7	4.4	2.0	3.1	3.3	3.7
1830	2.3	1.6	2.4	4.1	3.3	3.9	6.1	4.4	4.9	2.1	3.8	5.1	5.9
1900	3.4	4.0	1.8	4.2	5.6	4.1	7.9	7.1	3.3	3.2	4.7	6.1	8.8
1930	3.1	3.9	5.6	5.0	6.3	9.8	8.1	10.1	10.5	4.1	7.0	9.6	11.6
2000	3.2	4.1	4.9	2.9	7.4	7.2	4.6	10.2	9.5	4.0	5.8	8.1	13.4
2030	5.3	3.0	4.7	7.3	4.2	8.0	14.1	4.8	6.7	4.3	6.5	8.6	11.1
2100	2.7	5.1	6.1	3.6	9.6	20.4	10.0	11.4	21.1	4.6	11.2	14.2	19.1
2130	4.2	5.8	4.8	5.1	12.7	8.7	6.7	14.1	6.3	5.0	8.9	9.0	20.3
2200	3.9	5.1	6.7	10.3	6.7	13.4	10.9	10.9	18.8	5.2	10.1	13.5	16.0
2230	4.3	3.9	4.7	6.9	7.6	7.5	15.7	12.9	11.9	4.3	7.4	13.5	16.0
2300	6.7	2.6	2.7	13.7	4.9	5.3	14.4	8.7	6.1	4.1	8.0	9.8	12.9
2330	2.3	3.5	2.8	2.7	8.0	4.0	6.9	15.8	5.1	2.8	4.9	9.3	25.4
6/23													
0	5.5			9.8			16.4			1.9	3.3	5.5	9.7

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
30	12.1	12.0	6.7	22.5	25.2	13.4	32.3	34.0	10.9	10.4	20.3	25.8	29.5
100	2.0	2.9	2.3	3.0	3.6	3.2	5.2	5.0	4.5	2.4	3.3	4.9	5.2
130	6.3	3.1	5.2	8.6	4.9	11.7	11.1	9.2	19.4	4.9	8.4	13.2	14.4
200	6.3	9.0	9.4	9.3	21.7	17.0	12.1	25.5	15.2	8.2	16.0	17.6	23.0
230	7.5	9.1	8.8	11.3	11.5	19.6	19.6	18.1	22.5	8.5	14.2	20.1	20.0
300	13.2	5.4	6.7	18.4	7.5	12.8	24.2	9.2	14.2	8.5	12.9	15.9	17.6
330	7.1	2.5	3.9	16.1	3.8	9.1	24.7	4.9	9.8	4.5	9.7	13.1	19.1
400	.2			7.4			14.2			.1	2.5	4.7	8.6
430	4.2	4.0	1.6	6.6	5.3	2.8	7.7	8.2	2.0	3.3	5.1	6.0	7.1
500	1.6			3.9			8.9			.5	1.3	3.0	5.5
530	2.3			7.2			13.3			.8	2.4	4.4	8.0
600	3.0			5.4			8.9			1.1	2.0	3.0	5.3
630	1.3			2.3			3.9			.5	.9	1.3	2.3
700	1.1			2.0			3.3			.4	.7	1.1	1.9
830	7.1	4.9	4.3	11.9	5.9	12.9	12.2	7.8	23.3	5.5	10.2	14.5	22.0
900	3.5	10.0	9.1	5.4	10.9	14.8	9.7	19.1	15.4	7.5	10.4	14.8	17.0
1020	5.8	3.9	4.8	7.9	6.0	5.1	13.8	6.0	5.4	4.9	6.3	8.4	10.5
1050	2.9	3.6	4.8	4.6	4.6	7.2	4.6	6.4	10.6	3.7	5.5	7.2	7.6
1204	2.9	2.0	1.4	5.3	3.3	1.6	6.2	4.6	2.2	2.1	3.4	4.3	7.8
1234	1.9	1.9	2.1	2.2	3.3	3.7	3.8	3.3	4.2	2.0	3.0	3.8	3.9
1444	2.6	2.1	3.0	3.7	4.2	3.4	4.4	9.7	4.0	2.5	3.8	6.0	9.8
1524	1.9	2.1	1.6	2.2	3.2	4.9	3.4	5.3	3.9	1.9	3.4	4.2	6.2
2034	2.2	1.5	1.5	3.1	2.7	3.4	3.8	4.2	3.2	1.7	3.1	3.7	6.0
2140	3.2	2.4	2.3	6.1	4.6	3.5	10.5	6.5	4.3	2.6	4.8	7.1	13.0
2210	3.6	2.9	2.8	6.6	3.5	5.7	13.3	4.3	5.2	3.1	5.3	7.6	8.8
2337	8.3	3.5	2.9	12.8	5.5	10.1	16.1	8.4	10.8	5.0	9.5	11.8	14.1
6/24													
7	2.3	2.6	2.3	4.1	3.9	2.9	7.2	3.9	3.2	2.4	3.6	4.8	8.3
158	1.5	1.2	1.6	2.2	1.8	2.0	2.4	2.4	2.5	1.4	2.0	2.4	2.5
228	1.5	1.4	1.5	2.2	2.3	3.1	2.6	2.5	4.1	1.5	2.5	3.1	3.2
401	2.1	2.1	1.7	3.0	3.1	3.2	7.6	4.2	3.5	2.0	3.1	5.1	8.7
431	1.9	1.6	1.7	3.5	1.8	2.1	7.5	2.4	2.8	1.7	2.5	4.2	5.9
526	1.8	2.3	1.8	2.3	3.0	4.4	2.4	5.6	3.8	2.0	3.3	3.9	5.1
648	2.9	3.2	3.9	3.9	9.1	11.9	6.6	9.5	11.3	3.3	8.3	9.2	19.2
748	3.6	2.3	4.4	5.1	4.4	6.9	7.1	7.5	8.6	3.4	5.5	7.7	8.9
830	3.5	3.7		7.3	6.7		14.9	13.6		3.6	7.0	14.3	0.0
858	2.2	2.4	4.8	4.4	5.8	11.4	8.9	8.8		3.0	6.7	8.9	15.4
927	3.8	3.8		7.1	11.8		13.9	18.6		3.5	8.8	16.3	17.0
1000	5.5	4.9	2.5	8.2	10.0	8.7	22.8	17.6	11.8	4.3	9.0	17.4	21.6
1030	4.2	3.5	4.8	8.7	8.4	16.6	14.5	15.4	15.5	4.1	11.2	15.1	28.8
1100	2.7	2.0	3.3	4.0	4.5	9.2	13.8	11.1	15.6	2.6	5.9	13.5	13.6
1130	5.5	3.3	1.9	8.8	10.3	4.0	11.2	20.9	5.1	3.6	7.7	12.4	21.4
1154	2.8	2.6		6.4			15.4						
1230	1.4	1.6	1.8	2.2	3.2	5.0	2.5	7.5	5.6	1.6	3.5	5.2	18.5
1300	1.4	1.4	2.7	1.6	3.5	6.5	1.7	6.5	5.9	1.8	3.8	4.7	5.7
1330	3.6	1.8	1.7	7.7	2.8	4.3	16.6	3.6	3.7	2.4	4.9	8.0	14.2
1400	2.7	2.2	1.7	4.7	5.6	3.4	6.7	9.6	5.8	2.2	4.6	7.3	9.3
1430	1.7	1.6	1.4	2.2	1.6	3.1	3.9	2.8	2.6	1.6	2.3	3.1	3.9
1500	1.9	1.6	1.5	2.4	3.7	2.7	4.2	2.9	2.7	1.7	2.9	3.3	5.1

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1530	1.5	1.2	1.1	2.2	1.5	2.0	2.7	2.2	1.7	1.3	1.9	2.2	2.5
1600	1.3	1.7	1.4	1.6	2.6	2.1	1.9	3.0	2.5	1.4	2.1	2.5	2.8
1630	1.3	1.3	1.6	1.7	1.6	2.4	2.0	1.9	2.2	1.4	1.9	2.0	2.9
1700	1.4	1.9	.9	2.2	2.6	1.9	2.5	2.8	2.4	1.4	2.3	2.6	3.2
1730	1.7	1.3	1.3	2.4	2.0	2.2	2.5	2.3	2.0	1.4	2.2	2.3	2.4
1800	1.5	1.4	1.5	2.1	1.8	2.3	2.5	2.4	2.5	1.5	2.1	2.5	2.7
1830	1.8	1.3	1.4	3.1	2.3	1.7	3.4	2.5	2.5	1.5	2.4	2.8	3.8
1900	1.5	1.7	1.7	2.3	1.8	2.8	3.6	2.1	2.9	1.6	2.3	2.9	4.4
1930	2.1	1.4	1.3	2.3	2.5	1.8	2.7	2.3	1.8	1.6	2.2	2.2	2.6
2000	1.3	1.4	1.3	1.6	1.9	2.0	1.8	2.4	1.4	1.4	1.8	1.9	2.0
2030	2.1	2.8	1.4	2.4	3.5	2.6	3.7	3.9	2.2	2.1	2.9	3.3	3.4
2100	2.0	2.5	1.9	2.0	4.1	6.9	3.9	3.8	2.8	2.1	4.0	3.5	4.6
2130	1.2	1.2	1.4	1.6	1.6	2.1	2.0	2.2	2.6	1.2	1.8	2.3	2.4
2200	3.0			4.1			5.7						
2230	2.2	1.7	1.3	3.0	3.1	2.8	8.4	3.0	3.3	1.7	3.0	4.9	8.6
2300	1.0	1.6	1.7	1.2	2.0	3.0	4.2	3.3	3.6	1.4	2.1	3.7	6.6
2330	3.1	4.6	3.9	4.4	7.7	7.4	8.9	11.1	8.6	3.9	6.5	9.5	20.5
6/25													
0	3.4	2.5	3.2	4.5	5.9	3.7	5.0	6.8	3.4	3.0	4.7	5.4	5.9
30	3.4	1.5	1.7	3.7	2.9	5.7	4.3	6.4	6.1	2.2	4.1	5.6	7.0
100	3.9	2.9	2.6	7.1	6.2	8.4	16.9	11.6	11.3	3.2	7.2	13.3	25.4
130	2.6	2.5	3.3	4.4	4.2	8.0	4.7	9.9	12.8	2.8	5.5	9.1	20.3
200	5.7	13.7	7.6	7.5	31.6	24.7	13.9	56.9	22.6	9.1	21.3	31.1	82.9
230	8.0	4.9	4.9	14.2	12.1	12.5	26.4	11.5	13.3	6.0	13.0	17.3	27.5
300	3.5	4.4	5.2	8.2	5.9	9.4	13.0	7.0	13.7	4.3	7.9	11.3	14.7
330	2.4	1.7	1.1	3.5	4.8	2.6	8.6	4.9	3.7	1.8	3.6	5.8	6.5
400	1.1	1.4	3.6	1.7	1.5	7.9	4.5	2.6	7.9	2.0	3.7	5.0	6.4
430	2.9	1.8	2.5	5.0	3.4	3.9	7.0	4.1	5.6	2.4	4.1	5.6	5.7
500	3.3	4.0	2.7	8.3	8.7	5.3	9.9	10.6	5.6	3.3	7.4	8.7	12.1
530	5.2	3.5	6.2	8.7	4.6	9.5	10.4	9.7	13.4	4.9	7.6	11.2	15.0
600	5.7	3.7	2.5	13.3	4.7	4.7	15.5	5.4	6.1	4.1	7.9	9.0	12.6
630	2.2	3.0	1.7	4.2	5.2	3.8	4.9	6.1	5.3	2.3	4.4	5.5	6.0
700	3.7	2.6	1.6	6.7	4.6	3.8	8.4	8.7	3.3	2.7	5.2	6.8	10.8
730	2.0	2.0	2.5	3.0	3.1	5.8	3.8	7.0	6.8	2.1	4.0	5.9	6.5
800	1.7	1.1	2.0	2.3	2.1	4.2	3.1	2.6	5.5	1.6	2.9	3.7	7.1
830	3.0	2.0	3.4	4.1	3.9	7.3	5.3	8.0	9.9	2.8	4.8	7.7	15.3
900	2.2	1.8	2.6	2.6	2.8	5.5	3.9	4.1	8.1	2.2	3.6	5.4	6.3
930	5.2	2.6	3.2	8.0	3.7	5.0	11.6	3.8	7.5	3.7	5.6	7.7	14.7
1000	2.7	3.1	3.7	4.7	4.8	4.8	7.4	5.2	4.4	3.2	4.8	5.6	10.8
1030	2.9	3.1	2.2	3.3	3.5	2.9	4.0	4.6	4.1	2.8	3.2	4.2	5.9
1100	1.5	1.2	.9	1.8	1.4	1.5	2.2	1.5	1.4	1.2	1.6	1.7	2.0
1130	1.1	1.2	1.1	1.7	1.4	1.4	2.6	1.4	1.4	1.1	1.5	1.8	2.0
1200	.9	.9	1.0	1.0	1.5	1.1	1.7	1.7	1.5	.9	1.2	1.6	2.5
1230	1.2	1.2	1.0	1.5	1.5	1.3	1.6	1.7	1.3	1.1	1.4	1.5	1.7
1300	1.0	1.3	1.4	1.3	1.9	1.5	1.6	1.8	1.6	1.2	1.5	1.6	1.6
1330	1.4	1.8	1.3	1.6	2.3	1.7	1.9	2.0	2.0	1.5	1.9	2.0	2.2
1400	1.4	1.1	1.5	1.5	1.2	1.9	1.6	1.5	1.7	1.3	1.5	1.6	2.0
1430	1.5	1.2	1.0	1.5	1.6	1.5	1.7	1.5		1.3	1.6	1.6	1.6
1500	1.2	1.4	1.4	1.4	1.7	1.9	1.8	2.5	1.7	1.4	1.7	2.0	2.3

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1530	1.3	1.4	1.5	1.5	1.5	1.7	1.8	1.5	1.7	1.4	1.6	1.7	1.9
1600	1.3	1.5	1.4	1.3	1.6	1.4	1.3	1.6	1.5	1.4	1.4	1.5	1.6
1630	1.2	1.9	1.2	1.4	2.1	1.4	1.4	2.1	1.4	1.5	1.6	1.6	1.8
1700	1.2	1.3	2.0	1.3	1.4	2.4	1.9	1.6	2.5	1.5	1.7	2.0	3.1
1730	1.3	1.8	2.2	1.5	1.8	2.4	1.6	2.0	2.7	1.7	1.9	2.1	3.3
1800	1.4	1.3	1.6	1.F	1.6	2.0	1.6	1.9	1.8	1.4	1.7	1.8	2.1
1830	1.5	1.2	1.5	2.1	1.5	2.2	2.1	1.6	2.0	1.4	1.9	1.9	2.1
1913	1.4	2.6	3.6	1.8	4.3	4.8	1.9	6.5	4.3	2.5	3.7	4.2	12.0
1955	1.8	1.2	1.8	2.0	1.8	3.0	3.0	1.8	4.1	1.6	2.3	3.0	4.2
2025	1.2	1.1	1.1	1.8	1.4	1.5	2.3	1.7	1.5	1.1	1.6	1.8	3.5
2055	1.4	1.5	1.7	1.4	1.8	2.1	1.7	1.8	2.5	1.5	1.8	2.0	2.9
6/27													
1130	1.3	1.6	1.8	1.6	1.9	2.7	1.6	1.9	2.3	1.5	2.0	1.9	2.1
1200	1.4	1.7	1.7	1.6	2.2	2.0	2.2	3.1	2.1	1.6	1.9	2.5	3.9
1230	1.8	1.8	1.4	1.9	1.9	1.7	1.9	2.0	1.7	1.7	1.8	1.8	1.8
1300	1.6	1.6	1.0	1.7	1.8	2.1	1.8	1.9	1.7	1.4	1.9	1.8	1.8
1330	1.5	1.4	1.7	2.0	1.6	2.1	2.0	2.1	2.3	1.6	1.9	2.1	2.3
1400	1.8	1.7		2.2	2.0		2.4	2.0		1.7	2.1	2.2	0.0
1430	1.3	1.3	1.4	1.7	1.8	2.4	2.0	1.6	2.1	1.3	2.0	1.9	1.9
1500	1.6	1.7	1.7	1.9	1.7	2.4	2.4	1.9	2.0	1.7	2.0	2.1	2.2
1530	1.5	1.5	1.6	2.4	2.0	1.9	2.4	2.5	2.3	1.5	2.1	2.4	2.7
1600	1.7	1.6	1.6	1.9	2.2	1.6	1.9	2.3	1.9	1.6	1.9	2.0	2.1
1630	1.6	1.6	1.3	2.4	2.0	2.3	2.4	2.4	1.7	1.5	2.2	2.1	2.3
1700	1.6	1.4	1.4	1.7	1.9	2.2	2.0	1.8	2.4	1.5	1.9	2.1	2.2
2000	2.1	1.8	1.9	2.3	2.0	2.3	2.4	2.5	2.2	1.9	2.2	2.4	2.8
2030	2.0	2.1	1.8	2.6	3.2	2.9	3.1	2.9	2.6	2.0	2.9	2.9	3.0
2100	2.5	2.9	1.9	2.8	3.0	2.7	2.8	3.3	2.7	2.5	2.8	2.9	3.3
2130	2.1	1.6	1.7	2,7	2.4	1.8	3.6	2.3	2.0	1.8	2.3	2.6	3.2
2200	2.2	1.8	1.8	2.2	2.2	3.2	2.3	2.4	3.3	1.9	2.5	2.7	3.0
2230	1.7	1.6	2.0	2.4	2.8	3.7	2.6	3.2	3.7	1.8	3.0	3.2	4.0
2300	2.2	2.3	2.0	2.4	4.1	2.6	4.1	5.3	3.3	2.2	3.0	4.2	4.5
6/28													
0	1.8	1.6	1.4	2.0	2.2	1.6	2.8	5.2	1.7	1.6	1.9	3.2	5.4
30	1.3	1.8	1.7	2.1	2.0	3.2	2.1	3.4	4.3	1.6	2.4	3.3	4.8
100	2.0	1.5	1.1	2.3	1.8	2.6	4.6	1.9	2.3	1.6	2.2	2.9	4.5
130	2.1	1.8	2.3	3.8	3.1	4.6	14.1	7.8	5.5	2.1	3.9	9.1	11.1
200	1.9	2.9	1.8	3.0	5.6	4.3	4.0	8.0	6.7	2.2	4.3	6.2	7.6
230	1.6	3.5	2.1	2.6	5.0	3.3	4.0	5.7	3.7	2.4	3.6	4.5	5.1
300	1.5	3.9	4.3	1.9	8.3	8.7	2.7	22.0	9.5	3.2	6.3	11.4	28.0
330	3.2	5.9	4.4	5.7	11.7	6.3	9.1	21.9	4.8	4.5	7.9	11.9	29.7
400	5.0	25.4	22.0	5.0	38.1	26.9	6.5	73.0	32.9	17.3	23.4	37.4	89.9
430	13.9	9.3	4.3	36.7	10.9	10.0	85.8	13.2	9.0	9.4	19.2	36.0	58.5
500	5.3	17.9	18.0	6.5	26.4	29.3	11.8	48.9	25.6	13.5	20.7	28.8	53.4
526	9.6	18.4		13.0	7.1		24.5						
600	3.2	4.7	6.9	4.7	7.4	9.5	13.3	13.8	13.8	4.8	7.2	13.6	20.9
630	8.2	7.1	9.7	9.2	9.0	16.8	11.2	12.0	17.8	8.3	11.7	13.7	16.4
700	2.1	2.2	1.8	2.9	3.1	4.3	6.9	2.8	5.2	2.0	3.4	5.0	8.0
730	1.7	1.3	1.2	2.1	2.6	2.8	6.3	3.5	3.0	1.4	2.5	4.2	8.2
800	1.2	1.2	3.0	2.2	1.7	5.7	3.5	2.5	9.7	1.8	3.5	5.2	6.4

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period									1/2hr Period			
	1min Ave			3min Ave			10min Ave						
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
830	4.0	6.2	2.9	5.4	9.°	7.3	7.7	19.6	7.7	4.4	7.5	11.7	20.3
900	1.7	1.7	2.0	2.3	4.5	6.4	6.2	9.1	11.4	1.8	4.4	8.9	10.3
930	1.7	2.2	2.1	2.5	3.7	5.4	3.9	5.3	4.2	2.0	3.9	4.4	6.4
1000	1.9	2.4	1.7	4.5	2.9	3.8	11.3	4.0	2.7	2.0	3.7	6.0	7.9
1030	1.1	1.7	2.0	1.6	2.2	4.7	1.9	2.5	6.4	1.6	2.8	3.6	4.1
1100	1.0	4.1	1.4	1.9	15.6	1.6	3.2	20.8	1.9	2.2	6.4	8.6	17.7
1130	1.4	1.5	1.7	2.3	1.8	3.8	2.4	2.6	3.8	1.5	2.6	2.9	4.8
1200	3.9			7.0			11.8			1.5	2.6	5.9	7.3
1300	4.5	2.3	2.2	6.9	3.1	3.9	9.1	4.1	3.8	3.1	4.6	5.7	6.9
1330	1.6	1.8	1.1	2.6	4.2	2.6	2.7	4.5	2.0	1.6	3.1	3.1	3.4
1400	1.1	1.1	1.5	1.6	1.9	2.8	2.9	2.5	2.4	1.2	2.1	2.6	4.9
1430	1.6	1.5	1.8	3.0	2.0	2.2	3.0	2.2	2.3	1.6	2.4	2.5	2.8
1500	1.1	1.2	1.2	2.0	1.7	1.4	2.2	2.1	1.4	1.2	1.7	1.9	3.1
1530	.9	.8	1.0	1.3	1.4	1.4	2.6	1.5	1.4	.9	1.4	1.8	2.1
1600	1.1	1.0	1.0	1.6	1.3	1.6	1.8	1.6	1.8	1.0	1.5	1.7	1.9
1630	.8	.9	.9	1.1	1.3	1.7	1.1	1.9	1.8	.9	1.4	1.6	1.6
1700	1.2	1.0	.9	1.4	1.6	1.3	1.6	1.9	1.5	1.0	1.4	1.7	2.7
1730	1.1	1.0	.7	1.3	1.5	1.4	2.1	2.1	1.3	.9	1.4	1.8	3.3
1800	1.2	.9	.7	1.8	2.1	1.7	1.9	2.6	2.3	1.0	1.9	2.3	4.0
1830	.9	.8	.9	.9	1.0	1.5	2.0	1.2	1.7	.8	1.1	1.6	2.2
1900	.8	.8	1.0	1.0	1.5	1.1	1.9	2.3	1.1	.9	1.2	1.8	3.0
6/29													
800	1.3	2.0	1.9	2.3	4.5	5.4	4.0	11.9	4.0	1.7	4.0	6.6	9.3
830	1.3	1.1	.9	2.5	1.9	1.8	4.6	4.4	1.5	1.1	2.0	3.5	3.9
900	1.3	1.4	1.2	2.6	2.0	2.0	4.2	3.1	4.7	1.3	2.2	4.0	4.1
930	2.4	2.3	2.3	4.6	3.3	4.6	6.7	5.5	5.3	2.3	4.2	5.8	10.6
1000	1.9	1.7	1.4	2.4	2.6	5.6	5.9	4.7	3.7	1.7	3.5	4.8	7.2
1030	1.1	1.3	.8	1.6	2.9	2.3	2.6	4.0	3.7	1.1	2.3	3.4	3.6
1200	1.1	1.1	.8	1.7	2.3	1.1	3.2	5.9	1.3	1.0	1.7	3.5	7.2
1230	2.3	1.3	1.5	3.3	2.6	3.7	8.2	3.2	3.5	1.7	3.2	5.0	7.1
1300	1.7	1.6	1.8	2.4	3.1	5.1	3.3	8.2	4.9	1.7	3.5	5.5	10.0
1330	1.1	1.0	1.0	1.2	2.1	1.2	2.2	3.0	1.8	1.0	1.5	2.3	7.0
1430	.7	.8	.9	1.5	1.4	2.1	2.6	2.2	1.7	.8	1.7	2.2	3.1
1500	.7	.6	.4	1.2	1.0	.7	3.2	1.7	.7	.5	1.0	1.9	3.2
1530	1.0	.8	.9	2.0	1.3	1.3	2.4	1.3	1.5	.9	1.6	1.7	2.9
1600	.9	1.9	1.4	1.1	3.0	3.2	2.8	5.3	2.6	1.4	2.4	3.6	11.6
1630	.8	1.2	1.0	1.3	1.5	2.1	1.5	3.0	3.3	1.0	1.6	2.6	4.7
1700	1.2	1.0	1.1	2.0	1.8	2.6	4.0	2.7	2.7	1.1	2.1	3.1	5.8
1730	1.3	1.0	1.9	1.8	2.2	7.5	3.5	4.6	16.2	1.4	3.8	8.1	19.0
1800	2.1	2.4	1.4	5.4	6.5	5.0	16.5	14.0	8.0	2.0	5.6	12.8	29.2
6/30													
652	2.5	2.2	2.3	3.7	2.5	2.7	3.6	2.8	2.7	2.3	3.0	3.0	3.0
722	2.3	1.4	2.2	2.6	1.3	4.6	2.9	1.9	3.5	2.0	2.9	2.9	3.7
926	1.4	1.4	1.5	2.3	1.9	2.1	3.1	2.3	2.2	1.4	2.1	2.5	2.6
1008	2.0	2.2	1.5	2.1	2.4	2.8	2.1	2.5	2.5	1.9	2.4	2.3	2.7
1038	2.1	1.6	1.7	2.2	2.5	2.5	2.5	2.9	2.4	1.8	2.4	2.6	2.8
1248	2.9	2.9	1.5	6.2	9.2	4.8	14.9	11.4	6.8	2.5	6.4	11.0	23.6
1318	.6	.8	.7	.8	1.3	2.0	1.1	2.3	2.3	.7	1.4	1.9	5.9
1348	.9	1.4	1.5	1.2	2.2	2.9	1.3	1.8	3.4	1.3	2.1	2.2	4.9

BLM-4 WIND DIRCTION STANDARD DEVIATION (deg)

	10min Period														
	1min Ave			3min Ave			10min Ave			1/2hr Period					
Time	#1	#2	#3	#1	#2	#3	#1	#2	#3	1m	3m	10m	1/2h
1504	.9	.8	.9	1.4	1.0	1.7	2.0	1.4	2.1	.8	1.4	1.8	2.3
1543	1.1	1.0	1.0	1.7	1.4	1.9	2.0	1.2	2.0	1.0	1.6	1.7	2.7
1613	.9	.9	1.1	1.5	1.4	1.7	3.0	1.8	2.0	1.0	1.6	2.3	2.9
1725	1.1	1.0	1.1	2.1	1.5	2.3	2.8	2.1	2.1	1.1	2.0	2.3	2.4
1755	.9	.9	1.1	1.6	1.5	2.1	2.8	1.3	2.1	1.0	1.9	2.2	2.6
1825	.8	1.0	1.1	1.5	1.9	2.5	1.8	2.4	1.6	1.0	1.9	1.9	2.1
2012	1.7	1.3	2.0	1.9	1.9	2.6	2.9	2.1	2.4	1.6	2.1	2.5	3.0
2042	1.5	1.4	1.4	2.5	1.6	1.8	2.8	2.0	2.1	1.4	2.0	2.3	2.7
2233	2.5	2.9	2.6	3.4	3.2	3.8	4.6	4.0	3.8	2.7	3.5	4.1	4.2
7/01													
545	1.9	1.3	1.4	3.0	2.2	2.9	5.1	2.7	3.5	1.6	2.7	3.8	5.9
833	7.0	4.0	2.2	9.8	3.6	4.5	15.1	4.7	3.3	4.5	6.0	7.7	11.8
833	7.0	4.0	2.2	9.8	3.6	4.5	15.1	4.7	3.3	4.5	6.0	7.7	11.8
923	1.0	1.6	1.4	1.2	2.7	2.3	1.4	6.5	2.8	1.3	2.1	3.6	6.8
953	1.3	1.2	1.7	1.8	2.0	3.4	2.0	2.2	2.6	1.4	2.4	2.3	2.5
1023	1.4	1.3	1.5	1.6	1.9	2.6	1.8	2.2	3.0	1.4	2.0	2.3	2.8
1131	1.9	1.8	1.0	2.0	2.1	1.7	2.1	2.1	1.5	1.6	1.9	1.9	2.1
1312	2.0	2.1	1.4	2.6	2.4	2.6	3.0	2.8	2.3	1.8	2.5	2.7	[illegible].7
1342	1.5	2.0	2.3	2.2	2.5	3.0	2.9	2.8	3.3	1.9	2.6	3.0	3.3
1452	1.4	2.0	2.3	1.9	3.5	3.1	2.0	4.3	3.1	1.9	2.8	3.1	3.4
1522	1.9	1.8	1.7	2.2	2.2	2.5	2.7	2.2	2.5	1.8	2.3	2.5	2.6

Appendix E

LISTING OF DATA FILES

This listing of the data files used to process these data is presented only for possible future reference. The listing shows the following

Tape-Track-File on original HP9825 cassettes
Date
Start Time-End Time for the data collection period
Total Elapsed Time
Averaging Time for each wind average in the period
Number of wind averages in the period

A line through a listing indicates that file was not used for these data. The "S"s indicate the files for which stationary conditions existed.

BLM Cruise 1

1-0- 1	09/23	1612:00-1642:00	30.0	15.8	114	
1-0- 3	09/23	1721:00-1749:03	28.1	15.7	107	
1-0- 5	09/24	1138:53-1205:00	26.1	16.7	94	
1-0- 7	09/24	1234:48-1301:02	26.2	16.6	95	
1-0- 9	09/24	1330:47-1357:00	26.2	16.6	95	
1-0-11	09/24	1426:48-1453:00	26.2	16.7	94	
1-0-13	09/24	1523:08-1549:00	25.9	16.7	93	S
1-0-15	09/24	1618:57-1645:03	26.1	16.7	94	S
~~1-0-17~~	~~09/24~~	~~1740:44-1741:01~~	~~0.3~~	~~17.0~~	~~1~~	
~~1-0-19~~	~~09/24~~	~~1810:52-1837:07~~	~~26.3~~	~~22.2~~	~~91~~	
~~1-0-21~~	~~09/27~~	~~0647:00-0715:00~~	~~28.0~~	~~19.5~~	~~86~~	
1-0-23	09/27	0831:00-0859:00	28.0	15.7	107	
1-0-25	09/27	0946:57-1013:02	26.1	15.7	100	
1-0-27	09/27	1110:00-1138:02	28.0	15.6	108	S
1-0-29	09/27	1207:52-1234:02	26.2	15.5	101	
1-0-31	09/27	1303:52-1330:00	26.1	15.7	100	
1-0-33	09/27	1359:54-1426:00	26.1	15.7	100	
1-0-35	09/27	1456:00-1522:00	26.0	15.8	99	
1-0-37	09/27	1551:55-1618:01	26.1	15.7	100	
1-0-39	09/27	1647:55-1714:03	26.1	15.7	100	
1-0-41	09/27	1744:09-1810:01	25.9	15.7	99	
1-0-43	09/27	1840:11-1906:02	25.9	15.7	99	S
1-0-45	09/28	1308:55-1335:00	26.1	15.7	100	
1-0-47	09/28	1409:57-1436:01	26.1	15.6	100	S
1-0-49	09/28	1505:57-1532:00	26.1	15.6	100	
1-0-51	09/28	1602:01-1628:00	26.0	15.7	99	
2-0- 2	09/28	1741:48-1808:00	26.2	15.7	100	
2-0- 4	09/28	1837:50-1904:00	26.2	15.9	99	S
2-0- 6	09/29	1218:59-1245:00	26.0	14.7	106	
2-0- 8	09/29	1321:21-1347:00	25.7	14.7	105	S
2-0-10	09/29	1416:59-1443:00	26.0	14.7	106	
~~2-0-12~~	~~09/29~~	~~1517:09-1540:29~~	~~23.3~~	~~25.5~~	~~55~~	
2-0-14	09/29	1628:20-1654:00	25.7	14.8	104	
2-0-16	09/29	1723:58-1750:02	26.1	14.8	106	
2-0-18	09/29	1820:03-1846:00	26.0	14.8	105	
1-0- 2	09/23	1647:00-1717:00	30.0	15.8	114	
1-0- 4	09/24	1109:49-1137:00	27.2	16.6	98	
1-0- 6	09/24	1206:46-1233:03	26.3	15.6	95	
1-0- 8	09/24	1303:01-1329:01	26.0	16.6	94	
1-0-10	09/24	1358:46-1425:00	26.2	16.6	95	
1-0-12	09/24	1455:08-1521:00	25.9	16.7	93	S
1-0-14	09/24	1551:08-1617:00	25.9	16.7	93	
1-0-16	09/24	1646:53-1713:00	26.1	16.7	94	S
1-0-18	09/24	1743:02-1809:00	26.0	16.8	93	
~~1-0-20~~	~~09/24~~	~~1839:11-1905:00~~	~~25.8~~	~~32.3~~	~~40~~	
1-0-22	09/27	0716:54-0743:01	26.1	15.7	100	
1-0-24	09/27	0917:00-0945:00	28.0	15.7	107	
1-0-26	09/27	1014:54-1041:01	26.1	15.7	100	
1-0-28	09/27	1139:55-1206:00	26.1	15.7	100	S
1-0-30	09/27	1235:54-1302:00	26.1	15.7	100	
1-0-32	09/27	1331:52-1358:01	26.2	15.7	100	
1-0-34	09/27	1427:54-1454:00	26.1	15.7	100	
1-0-36	09/27	1524:03-1550:00	26.0	15.7	99	
1-0-38	09/27	1619:54-1646:00	26.1	15.7	100	
1-0-40	09/27	1715:59-1742:00	26.0	15.8	99	
1-0-42	09/27	1812:29-1838:01	25.5	15.8	97	S
1-0-44	09/28	1239:00-1307:00	28.0	15.7	107	
1-0-46	09/28	1340:00-1408:00	28.0	15.6	108	S
1-0-48	09/28	1437:56-1504:00	26.1	15.6	100	
1-0-50	09/28	1534:05-1600:01	25.9	15.7	99	
2-0- 1	09/28	1712:00-1740:00	28.0	15.7	107	
2-0- 3	09/28	1809:56-1836:00	26.1	15.8	99	S
2-0- 5	09/29	1149:16-1217:01	27.8	14.7	113	
2-0- 7	09/29	1251:35-1319:00	27.4	14.8	111	S
2-0- 9	09/29	1349:02-1415:00	26.0	14.7	116	
2-0-11	09/29	1444:49-1511:01	26.2	14.7	107	
2-0-13	09/29	1558:05-1626:02	28.0	14.7	114	
2-0-15	09/29	1656:01-1722:00	26.0	14.8	105	
2-0-17	09/29	1751:51-1818:01	26.2	14.8	106	
2-0-19	09/29	1840:03-1902:46	14.7	15.0	59	

BLM Cruise 2

~~2-0-20~~	~~01/04~~	~~1619:06-1624:01~~	~~4.9~~	~~17.4~~	~~17~~	2-0-21	01/05	0834:47-0904:02	29.3	14.7	119
2-0-22	01/06	1125:27-1155:00	29.6	16.1	110	2-0-23	01/06	1155:59-1225:00	29.0	16.3	107
2-0-24	01/06	1325:14-1355:00	29.8	15.8	113	2-0-25	01/06	1355:52-1425:01	29.2	15.8	111
2-0-26	01/06	1425:57-1455:03	29.1	15.7	111	2-0-27	01/06	1512:26-1542:01	29.6	15.8	112
2-0-28	01/06	1542:58-1612:02	29.1	15.7	111	2-0-29	01/06	1612:59-1642:01	29.0	15.8	110
2-0-30	01/06	1642:58-1712:00	29.0	15.8	110	2-0-31	01/06	1712:47-1742:00	29.2	15.9	110
2-0-32	01/06	1742:57-1812:01	29.1	15.9	110	2-0-33	01/06	1812:59-1842:00	29.0	15.8	110
2-0-34	01/06	1842:58-1912:00	29.0	15.8	110	2-0-35	01/06	1912:59-1942:00	29.0	15.8	110
2-0-36	01/07	1132:35-1202:01	29.4	15.9	111	2-0-37	01/07	1203:08-1232:00	28.9	15.9	109
2-0-38	01/07	1250:35-1320:03	29.5	15.8	112	2-0-39	01/07	1321:03-1350:00	29.0	15.8	110
2-0-40	01/07	1350:54-1420:00	29.1	15.9	110	2-0-41	01/07	1420:51-1450:00	29.2	15.9	110
2-0-42	01/09	1119:39-1149:00	29.4	16.0	110	2-0-43	01/09	1151:45-1221:02	29.3	15.8	111
2-0-44	01/09	1239:30-1309:01	29.5	16.0	111	2-0-45	01/09	1310:02-1339:00	29.0	15.9	109
2-0-46	01/09	1339:58-1409:01	29.1	15.8	110	2-0-47	01/09	1410:03-1439:01	29.0	15.8	110
2-0-48	01/09	1440:05-1509:00	28.9	15.9	109	2-0-49	01/09	1510:02-1539:01	29.0	16.0	109
2-0-50	01/09	1540:12-1609:00	28.8	15.9	109	2-0-51	01/09	1610:08-1639:00	28.9	15.9	109
2-0-52	01/09	1640:04-1709:00	28.9	15.9	109	2-0-53	01/09	1710:35-1739:00	28.4	15.9	107
2-0-54	01/09	1740:35-1809:00	28.4	15.9	107	2-0-55	01/13	0822:55-0852:00	29.1	13.8	126
2-0-56	01/13	0918:39-0948:00	29.4	13.9	127	2-0-57	01/13	1019:47-1049:00	29.2	13.9	126
2-0-58	01/13	1050:05-1119:01	28.9	13.9	125	2-0-59	01/13	1209:00-1239:00	30.0	13.8	130
2-0-60	01/13	1240:06-1309:00	28.9	13.9	125	2-1- 1	01/13	1310:06-1339:00	28.9	13.9	125
2-1- 2	01/13	1339:59-1409:03	29.2	13.8	127	2-1- 3	01/13	1409:51-1439:00	29.2	13.9	126
2-1- 4	01/13	1439:49-1509:01	29.2	13.8	127	2-1- 5	01/13	1509:51-1521:36	11.8	13.8	51
2-1- 6	01/13	1529:59-1559:00	29.0	13.8	126	2-1- 7	01/13	1559:50-1629:00	29.2	13.9	126
2-1- 8	01/13	1629:51-1659:00	29.2	13.9	126	2-1- 9	01/13	1659:51-1729:00	29.2	13.9	126
2-1-10	01/14	1100:17-1130:01	29.7	13.8	129	2-1-11	01/14	1130:54-1200:00	29.1	13.9	126
2-1-12	01/14	1200:52-1230:00	29.1	13.8	127	2-1-13	01/14	1230:54-1300:00	29.1	13.9	126
2-1-14	01/14	1300:50-1330:03	29.2	13.8	127	2-1-15	01/14	1330:55-1400:00	29.1	13.8	126
2-1-16	01/14	1400:53-1430:00	29.1	13.9	126	2-1-17	01/14	1430:54-1500:00	29.1	13.9	126
2-1-18	01/15	1411:34-1441:00	29.4	13.8	128	2-1-19	01/15	1441:57-1500:44	18.8	13.7	82
2-1-20	01/15	1522:09-1552:01	29.9	13.8	130	2-1-21	01/15	1552:50-1622:02	29.2	13.8	127
2-1-22	01/15	1622:59-1652:01	29.0	13.8	126	2-1-23	01/15	1653:05-1722:00	28.9	13.8	126
2-1-24	01/16	0908:47-0938:00	29.2	14.0	125	2-1-25	01/16	0939:01-1008:00	29.0	14.0	124
2-1-26	01/16	1020:43-1050:00	29.3	13.8	127	2-1-27	01/16	1050:57-1120:02	29.1	13.7	127
2-1-28	01/16	1120:58-1150:00	29.0	13.8	126	2-1-29	01/16	1150:54-1220:00	29.1	13.7	127
2-1-30	01/16	1220:57-1250:01	29.1	13.8	126	2-1-31	01/16	1250:58-1320:00	29.0	13.8	126
2-1-32	01/16	1320:58-1350:01	29.1	13.8	126	2-1-33	01/16	1350:59-1420:00	29.0	13.9	125
~~2-1-34~~	~~01/16~~	~~1420:58-1450:00~~	~~29.0~~	~~100.9~~	~~16~~	2-1-35	01/16	1450:57-1520:00	29.1	13.9	125 S
2-1-36	01/16	1520:59-1550:00	29.0	13.9	125 S	2-1-37	01/16	1550:59-1620:00	29.0	13.9	125 S

BLM Cruise 2

2-1-38	01/16	1621:00-1650:00	29.0	13.9	125	S
2-1-40	01/16	1721:00-1750:00	29.0	13.9	125	|
2-1-42	01/16	1821:03-1850:00	29.0	13.9	125	S
2-1-44	01/16	1921:01-1950:01	29.0	13.9	125	
2-1-46	01/16	2021:02-2050:00	29.0	13.9	125	
2-1-48	01/16	2121:03-2150:00	29.0	13.8	126	
2-1-50	01/16	2221:03-2250:00	29.0	13.8	126	

2-1-39	01/16	1650:59-1720:00	29.0	13.9	125	S
2-1-41	01/16	1751:00-1820:02	29.0	13.8	126	S
2-1-43	01/16	1851:01-1920:00	29.0	13.8	126	
2-1-45	01/16	1951:03-2020:00	29.0	13.9	125	
2-1-47	01/16	2051:02-2120:01	29.0	13.9	125	
2-1-49	01/16	2151:02-2220:00	29.0	13.8	126	

BLM Cruise 3

1-0- 1	12/05	1438:35-1448:00	9.4	14.1	40
1-0- 3	12/06	1117:11-1146:01	28.8	14.1	123
1-0- 5	12/07	0748:58-0818:01	29.1	13.9	125
1-0- 7	12/08	1059:53-1109:00	9.1	14.0	39
1-0- 9	12/08	1119:51-1129:00	9.2	13.4	41
1-0-12	12/08	1150:27-1159:00	8.6	13.5	38
1-0-13	12/08	1159:54-1209:00	9.1	13.3	41
1-0-15	12/08	1222:24-1252:00	29.6	13.3	134
1-0-17	12/08	1323:40-1352:00	28.3	13.2	129
1-0-19	12/08	1422:57-1452:00	29.1	13.2	132
1-0-21	12/08	1522:59-1552:01	29.0	13.2	132
1-0-23	12/08	1623:15-1652:00	28.8	13.3	130
1-0-25	12/08	1723:06-1752:01	28.9	13.2	131
1-0-27	12/08	1826:46-1852:00	25.2	13.3	114
1-0-29	12/08	1923:00-1952:00	29.0	13.3	131
1-0-31	12/08	2023:00-2052:00	29.0	13.3	131
1-0-33	12/08	2123:01-2152:01	29.0	13.3	131
1-0-35	12/08	2223:02-2252:01	29.0	13.3	131
1-0-37	12/08	2323:03-2352:01	29.0	13.3	131
1-0-39	12/09	0023:04-0052:00	28.9	13.3	131
1-0-41	12/09	0123:04-0152:00	28.9	13.3	131
1-0-43	12/09	0223:05-0252:00	28.9	13.2	131
1-0-45	12/09	0323:05-0352:00	28.9	13.2	131
1-0-47	12/09	0423:06-0452:01	28.9	13.2	131
1-0-49	12/09	0523:07-0552:00	28.9	13.2	131
1-0-51	12/09	0623:07-0652:00	28.9	13.2	131
1-0-53	12/09	0723:08-0752:00	28.9	13.3	130
1-0-55	12/09	0823:00-0852:00	29.0	13.3	131
1-0-57	12/09	0923:42-0952:00	28.3	13.3	128
1-0-59	12/09	1023:06-1052:00	28.9	13.2	131
1-1- 1	12/09	1123:06-1152:00	28.9	13.2	131
1-1- 3	12/09	1222:49-1252:00	29.2	13.3	132
1-1- 5	12/09	1322:47-1352:00	29.2	13.3	132
1-1- 7	12/09	1422:53-1452:00	29.1	13.2	132
1-1- 9	12/09	1522:55-1552:01	29.1	13.2	132
1-1-11	12/09	1622:49-1652:01	29.2	13.3	132
1-1-13	12/09	1722:55-1752:00	29.1	13.3	131
1-1-15	12/09	1822:52-1852:01	29.2	13.3	132
1-1-17	12/09	1922:57-1952:02	29.1	13.2	132
1-1-19	12/09	2022:57-2052:00	29.1	13.2	132

1-0- 2	12/06	1046:18-1116:00	29.7	14.1	126
1-0- 4	12/07	0718:00-0748:00	30.0	14.0	129
1-0- 6	12/07	0818:55-0848:00	29.1	14.0	125
1-0- 8	12/08	1109:51-1119:00	9.2	14.1	39
1-0-10	12/08	1129:51-1139:00	9.2	13.4	41
1-0-14	12/08	1209:53-1219:00	9.1	13.3	41
1-0-16	12/08	1256:23-1322:00	25.6	13.3	116
1-0-18	12/08	1352:57-1422:00	29.1	13.2	132
1-0-20	12/08	1453:06-1522:00	28.9	13.2	131
1-0-22	12/08	1552:57-1622:02	29.1	13.2	132
1-0-24	12/08	1653:10-1722:00	28.8	13.3	130
1-0-26	12/08	1753:09-1822:00	28.9	13.3	130
1-0-28	12/08	1853:24-1922:00	28.6	13.3	129
1-0-30	12/08	1953:01-2022:00	29.0	13.3	131
1-0-32	12/08	2053:01-2122:00	29.0	13.3	131
1-0-34	12/08	2153:02-2222:00	29.0	13.3	131
1-0-36	12/08	2253:03-2322:01	29.0	13.3	131
1-0-38	12/08	2353:03-0022:01	29.0	13.3	131
1-0-40	12/09	0053:04-0122:00	28.9	13.3	131
1-0-42	12/09	0153:05-0222:01	28.9	13.3	131
1-0-44	12/09	0253:05-0322:00	28.9	13.3	130
1-0-46	12/09	0353:06-0422:01	28.9	13.3	130
1-0-48	12/09	0453:07-0522:00	28.9	13.3	130
1-0-50	12/09	0553:07-0622:01	28.9	13.3	130
1-0-52	12/09	0653:07-0722:01	28.9	13.3	130
1-0-54	12/09	0753:15-0822:00	28.8	13.3	130
1-0-56	12/09	0853:09-0922:01	28.9	13.2	131
1-0-58	12/09	0953:02-1022:00	29.0	13.3	131
1-0-60	12/09	1053:09-1122:00	28.9	13.3	130
1-1- 2	12/09	1152:54-1222:01	29.1	13.2	132
1-1- 4	12/09	1252:48-1322:00	29.2	13.3	132
1-1- 6	12/09	1353:02-1422:00	29.0	13.4	130
1-1- 8	12/09	1452:54-1522:01	29.1	13.3	131
1-1-10	12/09	1552:59-1622:00	29.0	13.3	131
1-1-12	12/09	1652:52-1722:00	29.1	13.3	131
1-1-14	12/09	1752:55-1822:00	29.1	13.3	131
1-1-16	12/09	1852:58-1922:00	29.0	13.3	131
1-1-18	12/09	1952:59-2022:00	29.0	13.3	131
1-1-20	12/09	2052:57-2122:00	29.1	13.2	132

BLM Cruise 3

1-1-21	12/09	2122:58-2152:00	29.0	13.2	132
1-1-23	12/09	2222:59-2252:00	29.0	13.3	131
1-1-25	12/09	2322:59-2352:00	29.0	13.3	131
1-1-27	12/10	0023:00-0052:00	29.0	13.3	131
1-1-29	12/10	0123:00-0152:00	29.0	13.3	131
1-1-31	12/10	0223:01-0252:00	29.0	13.3	131
1-1-33	12/10	0323:02-0352:00	29.0	13.3	131
1-1-35	12/10	0423:03-0452:00	29.0	13.3	131
1-1-37	12/10	0523:03-0552:00	29.0	13.3	131
1-1-39	12/10	0623:04-0652:00	28.9	13.3	131
1-1-41	12/10	0723:05-0752:00	28.9	13.2	131
1-1-43	12/10	0823:01-0852:22	29.4	14.7	120
1-1-45	12/10	0923:05-0952:00	28.9	13.2	131
1-1-47	12/10	1023:04-1052:00	28.9	13.3	131
1-1-49	12/10	1123:08-1152:00	28.9	13.2	131
1-1-51	12/10	1223:03-1252:00	29.0	13.3	131
1-1-53	12/10	1323:08-1352:02	28.9	13.2	131
1-1-55	12/10	1423:08-1452:00	28.9	13.2	131
1-1-57	12/10	1523:09-1552:00	28.9	13.3	130
1-1-59	12/10	1623:16-1652:00	28.7	13.3	130
2-0- 1	12/10	1916:46-1946:00	29.2	13.3	132
2-0- 3	12/10	2016:53-2046:00	29.1	13.3	131
2-0- 5	12/10	2130:55-2200:00	29.1	13.3	131
2-0- 7	12/10	2230:54-2300:00	29.1	13.3	131
2-0- 9	12/10	2330:55-0003:00	29.1	13.2	132
2-0-11	12/11	0030:55-0103:00	29.1	13.2	132
2-0-13	12/11	0130:58-0200:00	29.0	13.3	131
2-0-15	12/11	0230:56-0300:01	29.1	13.2	132
2-0-17	12/11	0330:56-0400:00	29.1	13.3	131
2-0-19	12/11	0430:57-0500:00	29.1	13.3	131
2-0-21	12/11	0530:58-0600:00	29.0	13.2	132
2-0-23	12/11	0630:59-0700:00	29.0	13.2	132
2-0-25	12/11	0730:59-0800:00	29.0	13.3	131
2-0-27	12/11	0831:00-0900:00	29.0	13.3	131
2-0-29	12/11	0931:01-1000:00	29.0	14.0	124
2-0-31	12/11	1031:00-1100:01	29.0	14.0	124
2-0-33	12/11	1131:01-1200:00	29.0	14.0	124
2-0-35	12/11	1231:01-1300:01	29.0	14.0	124
2-0-37	12/11	1331:02-1400:00	29.0	14.0	124

1-1-22	12/09	2152:45-2222:01	29.3	13.3	132
1-1-24	12/09	2252:59-2322:00	29.0	13.3	131
1-1-26	12/09	2352:59-0022:00	29.0	13.3	131
1-1-28	12/10	0053:00-0122:00	29.0	13.3	131
1-1-30	12/10	0153:00-0222:00	29.0	13.3	131
1-1-32	12/10	0253:01-0322:00	29.0	13.3	131
1-1-34	12/10	0353:02-0422:01	29.0	13.3	131
1-1-36	12/10	0453:02-0522:00	29.0	13.3	131
1-1-38	12/10	0553:02-0622:00	29.0	13.3	131
1-1-40	12/10	0653:04-0722:01	29.0	13.3	131
1-1-42	12/10	0753:01-0822:00	29.0	13.3	131
1-1-44	12/10	0853:20-0922:00	28.7	13.3	129
1-1-46	12/10	0953:05-1022:00	28.9	13.3	130
1-1-48	12/10	1053:06-1122:00	28.9	13.2	131
1-1-50	12/10	1214:15-1222:00	7.8	13.3	35
1-1-52	12/10	1253:02-1322:00	29.0	13.3	131
1-1-54	12/10	1353:15-1422:00	28.8	13.3	130
1-1-56	12/10	1453:08-1522:00	28.9	13.3	130
1-1-58	12/10	1553:09-1622:01	28.9	13.3	130
1-1-60	12/10	1653:17-1722:00	28.7	13.3	130
2-0- 2	12/10	1946:52-2016:00	29.1	13.3	131
2-0- 4	12/10	2100:00-2130:01	30.0	13.1	137
2-0- 6	12/10	2201:23-2230:00	28.6	13.2	130
2-0- 8	12/10	2300:54-2330:00	29.1	13.1	133
2-0-10	12/11	0000:55-0030:00	29.1	13.1	133
2-0-12	12/11	0100:56-0130:02	29.1	13.1	133
2-0-14	12/11	0200:56-0230:00	29.1	13.2	132
2-0-16	12/11	0300:57-0330:00	29.1	13.2	132
2-0-18	12/11	0400:56-0430:00	29.1	13.2	132
2-0-20	12/11	0500:58-0530:00	29.0	13.2	132
2-0-22	12/11	0600:58-0630:01	29.1	13.1	133
2-0-24	12/11	0700:59-0730:00	29.0	13.2	132
2-0-26	12/11	0800:59-0830:00	29.0	13.2	132
2-0-28	12/11	0901:00-0930:00	29.0	13.3	131
2-0-30	12/11	1001:05-1030:00	28.9	14.0	124
2-0-32	12/11	1101:01-1130:00	29.0	13.9	125
2-0-34	12/11	1201:01-1230:00	29.0	13.9	125
2-0-36	12/11	1301:08-1330:00	28.9	14.0	124
2-0-38	12/11	1400:54-1430:00	29.1	14.0	125

BLM Cruise 3

2-0-39	12/11	1431:03-1500:01	29.0	14.0	124	S
2-0-41	12/11	1531:11-1600:01	28.8	14.1	123	
2-0-43	12/11	1631:14-1657:01	25.8	13.9	111	
2-0-45	12/11	1725:04-1751:00	25.9	13.9	112	
2-0-47	12/11	1819:10-1845:00	25.8	14.0	111	S
2-0-49	12/11	1913:05-1939:00	25.9	13.9	112	
~~2-0-51~~	~~12/12~~	~~0024:00-0030:00~~	~~5.9~~	~~14.1~~	~~25~~	
2-0-53	12/12	0902:04-0931:02	29.0	14.0	124	
2-0-55	12/13	0716:54-0730:00	13.1	14.0	56	
2-0-57	12/13	0802:04-0831:00	28.9	14.0	124	
2-0-59	12/13	0901:10-0928:02	26.9	14.0	115	
2-1- 1	12/10	1027:24 1057:01	29.6	13.2	135	×
~~2-1- 3~~	~~12/13~~	~~1030:49-1100:00~~	~~29.2~~	~~16.5~~	~~106~~	
2-1- 5	12/13	1130:58-1200:00	29.0	13.0	134	
2-1- 7	12/13	1230:54-1300:00	29.1	14.1	124	
2-1- 9	12/13	1331:05-1400:00	28.9	14.1	123	S
2-1-11	12/13	1430:56-1500:00	29.1	13.4	130	
2-1-13	12/13	1530:55-1600:00	29.1	13.0	134	
2-1-15	12/13	1630:56-1700:01	29.1	14.1	124	
2-1-17	12/13	1731:02-1800:00	29.0	14.0	124	
2-1-19	12/13	1830:57-1900:00	29.1	14.1	124	S
2-1-21	12/13	1930:58-2000:01	29.1	13.9	125	
2-1-24	12/13	2104:03-2130:03	26.0	15.3	102	
2-1-25	12/13	2131:00-2200:00	29.0	14.0	124	
2-1-27	12/13	2230:59-2300:00	29.0	14.0	124	
2-1-29	12/13	2331:18-0000:00	28.7	14.0	123	
2-1-31	12/14	0030:00-0058:00	28.0	14.0	120	
2-1-33	12/14	0128:00-0156:00	28.0	14.0	120	
2-1-35	12/14	0226:01-0254:01	28.0	13.9	121	
2-1-37	12/14	0324:02-0352:00	28.0	14.0	120	
2-1-39	12/14	0422:03-0450:00	28.8	14.0	120	
2-1-41	12/14	0520:04-0548:00	27.9	14.0	120	
2-1-43	12/14	0618:04-0646:00	27.9	14.1	119	
2-1-45	12/14	0730:15-0800:00	29.8	14.1	127	
2-1-47	12/14	0831:07-0900:01	28.9	14.0	124	
2-1-49	12/14	0931:21-1000:00	28.7	14.0	123	
2-1-51	12/14	1031:07-1100:00	28.9	14.1	123	
2-1-53	12/14	1131:07-1200:00	28.9	14.0	124	S
2-1-55	12/14	1231:07-1300:01	28.9	14.0	124	
2-1-57	12/14	1331:09-1400:00	28.9	14.1	123	

2-0-40	12/11	1501:04-1530:01	29.0	13.9	125	S
2-0-42	12/11	1603:12-1630:00	26.8	14.0	115	
2-0-44	12/11	1657:57-1724:00	26.1	14.0	112	
2-0-46	12/11	1752:04-1818:01	26.0	13.9	112	
2-0-48	12/11	1846:05-1912:00	25.9	14.0	111	S
2-0-50	12/11	1940:06-2006:00	25.9	14.0	111	
2-0-52	12/12	0831:23-0901:01	29.6	14.1	126	
2-0-54	12/12	0932:09-1001:00	28.9	14.1	123	
2-0-56	12/13	0731:55-0801:00	29.1	14.2	123	
2-0-58	12/13	0832:40-0900:01	27.4	14.0	117	
2-0-60	12/13	0930:00-1000:01	30.0	14.1	128	
2-1- 2	12/13	1001:08-1030:00	28.9	14.0	124	
2-1- 4	12/13	1100:45-1130:00	29.3	12.9	136	
2-1- 6	12/13	1200:53-1230:00	29.1	13.4	130	
2-1- 8	12/13	1300:49-1330:00	29.2	14.0	125	
2-1-10	12/13	1400:54-1430:00	29.1	14.0	125	S
2-1-12	12/13	1500:55-1530:00	29.1	12.9	135	
2-1-14	12/13	1600:51-1630:00	29.2	14.1	124	
2-1-16	12/13	1700:51-1730:01	29.2	14.0	125	
2-1-18	12/13	1800:57-1830:00	29.1	13.9	125	S
2-1-20	12/13	1900:58-1930:00	29.0	13.9	125	
2-1-22	12/13	2000:59-2030:00	29.0	13.9	125	
2-1-26	12/13	2200:59-2230:00	29.0	13.9	125	
2-1-28	12/13	2304:41-2330:00	25.3	13.9	109	
2-1-30	12/14	0001:00-0029:00	28.0	14.0	120	
2-1-32	12/14	0059:00-0127:00	28.0	14.0	120	
2-1-34	12/14	0157:01-0225:00	28.0	14.0	120	
2-1-36	12/14	0255:03-0323:00	28.0	14.0	120	
2-1-38	12/14	0353:02-0421:00	28.0	14.0	120	
2-1-40	12/14	0451:03-0519:01	28.0	14.1	119	
2-1-42	12/14	0549:03-0617:00	28.0	14.0	120	
2-1-44	12/14	0708:03-0728:01	20.0	14.1	85	
2-1-46	12/14	0801:05-0830:02	29.0	13.9	125	
2-1-48	12/14	0901:07-0930:01	28.9	13.9	125	
2-1-50	12/14	1001:06-1030:00	28.9	14.0	124	
2-1-52	12/14	1101:05-1130:00	28.9	13.9	125	
2-1-54	12/14	1201:07-1230:00	28.9	14.0	124	S
2-1-56	12/14	1301:09-1330:01	28.9	14.0	124	
2-1-58	12/14	1401:09-1430:00	28.9	14.1	123	

BLM Cruise 3

2-1-59	12/14	1430:59-1500:00	29.0	13.0	134	S
3-0- 1	12/14	2230:00-2300:00	30.0	13.5	133	
3-0- 3	12/14	2330:51-0000:00	29.2	13.5	130	
3-0- 5	12/15	0030:55-0100:00	29.1	13.5	129	
3-0- 7	12/15	0130:54-0200:00	29.1	13.5	129	
3-0- 9	12/15	0230:55-0300:01	29.1	13.5	129	
3-0-11	12/15	0330:55-0400:00	29.1	13.5	129	
3-0-13	12/15	0430:56-0500:00	29.1	13.5	129	
3-0-15	12/15	0530:56-0600:00	29.1	13.5	129	
3-0-17	12/15	0630:57-0700:00	29.1	13.5	129	
3-0-19	12/15	0731:07-0800:01	28.9	13.5	128	
3-0-21	12/15	0900:00-0930:00	30.0	13.4	134	
3-0-23	12/15	1008:58-1028:01	19.1	13.4	85	
3-0-25	12/15	1048:58-1108:00	19.0	13.6	84	
3-0-27	12/15	1128:58-1148:00	19.0	13.4	85	
3-0-29	12/15	1209:00-1228:00	19.0	13.6	84	
3-0-31	12/15	1248:59-1308:00	19.0	13.6	84	
3-0-33	12/15	1329:00-1348:01	19.0	13.4	85	
3-0-35	12/15	1409:00-1428:00	19.0	13.6	84	
3-0-37	12/15	1500:00-1530:01	30.0	13.4	134	
3-0-39	12/15	1600:54-1630:00	29.1	13.4	130	
3-0-41	12/15	1701:03-1730:00	29.0	13.4	130	
3-0-43	12/15	1801:09-1830:00	28.9	13.4	129	
3-0-45	12/15	1901:26-1930:00	28.6	13.4	128	
3-0-47	12/15	2230:12-2300:01	29.8	13.6	132	
3-0-49	12/15	2331:06-0000:00	28.9	13.5	128	
3-0-51	12/16	0031:07-0100:01	28.9	13.5	128	
3-0-53	12/16	0131:09-0200:00	28.9	13.5	128	
3-0-55	12/16	0231:11-0251:53	20.7	13.5	92	
3-0-57	12/16	0314:07-0326:09	12.0	13.4	54	
3-0-59	12/16	0402:05-0421:00	18.9	13.5	84	
3-1- 1	12/14	1546:38-1559:00	12.4	13.0	57	S
3-1- 3	12/14	1612,48-1625:00	12.2	13.1	56	
3-1- 5	12/14	1638:50-1651:00	12.2	13.0	56	
3-1- 7	12/14	1704:52-1717:00	12.1	13.0	56	
3-1- 9	12/14	1730:48-1743:00	12.2	13.1	56	
3-1-11	12/14	1756:52-1809:00	12.1	13.0	56	
3-1-13	12/14	1822:52-1835:00	12.1	13.0	56	
~~3-1-15~~	~~12/14~~	~~1640:52-1901:02~~	~~12.2~~	~~52.1~~	~~14~~	
3-1-17	12/14	1935:19-1958:00	22.7	13.0	105	

2-1-60	12/14	1501:09-1530:00	28.9	12.9	134	S
3-0- 2	12/14	2300:52-2330:00	29.1	13.4	130	
3-0- 4	12/15	0000:53-0030:02	29.2	13.4	131	
3-0- 6	12/15	0100:53-0130:01	29.1	13.4	130	
3-0- 8	12/15	0200:53-0230:01	29.1	13.4	130	
3-0-10	12/15	0300:55-0330:00	29.1	13.4	130	
3-0-12	12/15	0400:55-0430:01	29.1	13.4	130	
3-0-14	12/15	0500:55-0530:00	29.1	13.4	130	
3-0-16	12/15	0600:56-0630:01	29.1	13.4	130	
3-0-18	12/15	0700:57-0730:00	29.1	13.6	128	
3-0-22	12/15	0937:41-1007:00	29.3	13.6	129	
3-0-24	12/15	1028:51-1048:01	19.2	13.4	86	
3-0-26	12/15	1108:52-1128:01	19.2	13.5	85	
3-0-28	12/15	1148:58-1208:02	19.1	13.5	85	
3-0-30	12/15	1228:56-1248:00	19.1	13.5	85	
3-0-32	12/15	1308:59-1328:01	19.0	13.4	85	
3-0-34	12/15	1349:01-1408:00	19.0	13.6	84	
3-0-36	12/15	1429:01-1448:00	19.0	13.4	85	
3-0-38	12/15	1531:12-1600:00	28.8	13.5	128	
3-0-40	12/15	1631:03-1700:00	29.0	13.5	129	
3-0-42	12/15	1731:04-1800:00	28.9	13.5	129	
3-6-44	12/15	1831:05-1900:00	28.9	13.6	128	
3-0-46	12/15	1931:33-2000:00	28.5	13.4	127	
3-0-48	12/15	2301:06-2330:00	28.9	13.4	129	
3-0-50	12/16	0001:05-0030:00	28.9	13.4	129	
3-0-52	12/16	0101:08-0130:02	28.9	13.3	130	
3-0-54	12/16	0201:07-0230:01	28.9	13.3	130	
3-0-56	12/16	0253:18-0313:00	19.7	13.6	87	
3-0-58	12/16	0341:04-0401:00	19.9	13.6	88	
3-0-60	12/16	0422:08-0441:00	18.9	13.5	84	
3-1- 2	12/14	1600:08-1612:00	11.9	12.9	55	S
3-1- 4	12/14	1625:49-1638:00	12.2	13.1	56	
3-1- 6	12/14	1651:50-1704:02	12.2	13.1	56	
3-1- 8	12/14	1717:50-1730:01	12.2	13.1	56	
3-1-10	12/14	1743:51-1756:01	12.2	13.0	56	
3-1-12	12/14	1809:52-1822:00	12.1	13.0	56	
3-1-14	12/14	1835:53-1848:00	12.1	13.0	56	
3-1-16	12/14	1902:40-1929:00	26.3	13.0	122	
3-1-18	12/14	2000:00-2030:00	30.0	12.9	139	

BLM Cruise 3

3-1-19	12/14	2030:57-2100:00	29.1	13.0	134	
3-1-21	12/16	0501:56-0521:00	19.1	13.5	85	
3-1-23	12/16	0541:57-0601:01	19.1	13.6	84	
3-1-25	12/16	0621:57-0641:02	19.1	13.5	85	
3-1-27	12/16	0701:58-0721:01	19.1	13.4	85	
3-1-29	12/16	0741:58-0801:00	19.0	13.8	83	
3-1-31	12/16	0821:59-0841:00	19.0	13.6	84	
3-1-33	12/16	0901:58-0921:00	19.0	13.4	85	
3-1-35	12/16	0942:00-1001:01	19.0	13.6	84	
3-1-37	12/16	1021:59-1041:02	19.1	13.4	85	
3-1-39	12/16	1114:05-1129:00	14.9	13.6	66	
3-1-41	12/16	1145:01-1159:00	14.0	13.5	62	
3-1-43	12/16	1214:55-1229:01	14.1	13.4	63	
3-1-45	12/16	1245:02-1259:00	14.0	13.5	62	S
3-1-47	12/16	1315:03-1329:01	14.0	13.5	62	
3-1-49	12/16	1400:58-1430:00	29.0	13.4	130	
3-1-51	12/16	1501:07-1530:00	28.9	13.4	129	
3-1-53	12/16	1630:00-1700:00	30.0	13.5	133	
3-1-55	12/16	1731:08-1800:00	28.9	13.5	128	S
3-1-57	12/16	1831:13-1900:00	28.8	13.5	128	
3-1-59	12/16	1931:08-2000:00	28.9	13.5	128	
4-1- 1	12/17	0800:00-0830:00	30.0	13.5	133	
4-1- 3	12/17	0900:53-0930:00	29.1	13.4	130	
4-1- 5	12/17	1000:49-1030:01	29.2	13.4	131	
4-1- 7	12/17	1100:54-1130:01	29.1	13.4	130	
4-1- 9	12/17	1200:55-1230:00	29.1	13.3	131	
4-1-11	12/17	1300:55-1330:01	29.1	13.3	131	
4-1-13	12/17	1401:17-1430:01	28.7	13.4	129	
4-1-15	12/17	1500:54-1530:00	29.1	13.3	131	
4-1-17	12/17	1600:57-1630:00	29.1	13.5	129	
4-1-19	12/17	1700:57-1730:00	29.1	13.4	130	
4-1-21	12/17	1800:58-1830:00	29.0	13.4	130	
4-1-23	12/17	1900:59-1930:01	29.0	13.4	130	
4-1-25	12/17	2000:59-2030:00	29.0	13.4	130	
4-1-27	12/17	2101:00-2130:00	29.0	13.4	130	
4-1-29	12/17	2201:00-2230:01	29.0	13.4	130	
4-1-31	12/17	2301:00-2330:00	29.0	13.4	130	S
4-1-33	12/18	0001:00-0030:00	29.0	13.4	130	
4-1-35	12/18	0101:02-0130:00	29.0	13.4	130	

3-1-20	12/16	0442:08-0501:01	18.9	13.7	83	
3-1-22	12/16	0521:56-0541:01	19.1	13.5	85	
3-1-24	12/16	0601:57-0621:00	19.1	13.4	85	
3-1-26	12/16	0641:59-0701:01	19.0	13.8	83	
3-1-28	12/16	0721:59-0741:00	19.0	13.6	84	
3-1-30	12/16	0801:58-0821:00	19.0	13.6	84	
3-1-32	12/16	0841:59-0901:02	19.1	13.6	84	
3-1-34	12/16	0921:59-0941:00	19.0	13.6	84	
3-1-36	12/16	1002:02-1021:01	19.0	13.4	85	
3-1-38	12/16	1042:03-1101:00	19.0	13.7	83	
3-1-40	12/16	1130:00-1144:00	14.0	13.5	62	
3-1-42	12/16	1159:53-1214:00	14.1	13.4	63	
3-1-44	12/16	1230:06-1244:00	13.9	13.5	62	
3-1-46	12/16	1300:02-1314:00	14.0	13.5	62	S
3-1-48	12/16	1330:21-1400:00	29.7	13.5	132	
3-1-50	12/16	1431:07-1500:01	28.9	13.4	129	
3-1-52	12/16	1531:05-1600:01	28.9	13.5	129	
3-1-54	12/16	1701:07-1730:00	28.9	13.4	129	
3-1-56	12/16	1801:08-1830:00	28.9	13.4	129	S
3-1-58	12/16	1901:08-1930:00	28.9	13.4	129	
3-1-60	12/16	2001:08-2030:00	28.9	13.4	129	
4-1- 2	12/17	0831:11-0900:01	28.8	13.7	126	
4-1- 4	12/17	0930:52-1000:00	29.1	13.4	130	
4-1- 6	12/17	1030:54-1100:00	29.1	13.5	129	
4-1- 8	12/17	1130:55-1200:01	29.1	13.5	129	
4-1-10	12/17	1230:55-1300:00	29.1	13.4	130	
4-1-12	12/17	1330:56-1400:00	29.1	13.5	129	
4-1-14	12/17	1430:57-1500:00	29.1	13.5	129	
4-1-16	12/17	1530:56-1600:01	29.1	13.5	129	
4-1-18	12/17	1631:05-1700:60	28.9	13.6	128	
4-1-20	12/17	1730:58-1800:60	29.0	13.5	129	
4-1-22	12/17	1830:58-1900:61	29.1	13.5	129	
4-1-24	12/17	1930:56-2000:00	29.1	13.5	129	
4-1-26	12/17	2030:59-2100:00	29.0	13.5	129	
4-1-28	12/17	2131:00-2200:00	29.0	13.5	129	
4-1-30	12/17	2231:02-2300:00	29.0	13.5	129	
4-1-32	12/17	2331:01-0000:00	29.0	13.5	129	S
4-1-34	12/18	0030:59-0100:00	29.0	13.5	129	
4-1-36	12/18	0131:02-0200:00	29.0	13.5	129	

BLM Cruise 3

4-1-37	12/18	0200:57-0230:00	29.1	13.4	130	S
4-1-39	12/18	0301:02-0330:00	29.0	13.5	129	
4-1-41	12/18	0401:03-0430:00	29.0	13.5	129	
4-1-43	12/18	0501:04-0530:01	29.0	13.5	129	
4-1-45	12/18	0601:03-0630:00	29.0	13.5	129	

4-1-38	12/18	0231:02-0300:00	29.0	13.5	129	S
4-1-40	12/18	0331:03-0400:00	29.0	13.6	128	
4-1-42	12/18	0431:04-0500:01	29.0	13.6	128	
~~4-1-44~~	~~12/18~~	~~0531:05-0600:00~~	~~28.9~~	~~17.9~~	~~97~~	
4-1-46	12/18	0631:05-0700:01	28.9	13.6	128	

GLM Cruise 4

1-0- 1	06/20	1841:21-1851:01	9.7	14.1	41	
1-0- 3	06/20	1947:28-1957:01	9.6	14.7	39	
1-0- 5	06/20	2144:40-2214:01	29.4	14.7	120	
~~1-0- 7~~	~~06/20~~	~~2234:54-2239:00~~	~~4.1~~	~~13.7~~	~~18~~	
1-0- 9	06/20	2330:00-0000:00	30.0	13.3	135	
1-0-11	06/21	0030:55-0100:00	29.1	13.4	130	
1-0-13	06/21	0130:56-0200:00	29.1	13.4	130	
1-0-15	06/21	0230:56-0300:00	29.1	13.3	131	
1-0-17	06/21	0330:58-0400:00	29.0	13.3	131	
1-0-19	06/21	0430:59-0500:01	29.0	13.4	130	
1-0-21	06/21	0530:58-0600:01	29.1	13.3	131	
1-0-23	06/21	0630:59-0700:00	29.0	13.3	131	
1-0-25	06/21	0730:58-0800:00	29.0	13.4	130	
1-0-27	06/21	0905:14-0935:00	29.8	13.3	134	
1-0-29	06/21	1031:20-1100:00	28.7	13.3	129	
1-0-31	06/21	1131:12-1200:02	28.8	13.3	130	
1-0-33	06/21	1231:02-1300:00	29.0	13.3	131	S
1-0-35	06/21	1331:09-1400:00	28.9	13.3	130	
1-0-37	06/21	1430:58-1500:00	29.0	13.3	131	
1-0-39	06/21	1531:07-1600:01	28.9	13.3	130	
1-0-41	06/21	1631:04-1700:00	28.9	13.4	130	
1-0-43	06/21	1750:07-1800:00	9.9	13.5	44	
1-0-45	06/21	2000:00-2030:00	30.0	13.3	135	
1-0-47	06/21	2101:06-2130:00	28.9	13.3	130	
1-0-49	06/21	2201:06-2230:00	28.9	13.3	130	
1-0-51	06/21	2301:08-2330:01	28.9	13.3	130	
1-0-53	06/22	0001:08-0030:00	28.9	13.3	130	S
1-0-55	06/22	0101:07-0130:00	28.9	13.3	130	
1-0-57	06/22	0201:08-0230:00	28.9	13.3	130	
1-0-59	06/22	0301:09-0330:00	28.9	13.3	130	
1-1- 1	06/22	0401:09-0430:00	28.9	13.3	130	
1-1- 3	06/22	0500:53-0530:00	29.1	13.3	131	
1-1- 5	06/22	0601:06-0630:00	28.9	13.3	130	
1-1- 7	06/22	0730:00-0800:01	30.0	13.3	135	
1-1- 9	06/22	0830:54-0900:00	29.1	13.3	131	
1-1-11	06/22	0930:51-1000:00	29.2	13.4	131	
1-1-13	06/22	1030:59-1100:00	29.0	13.4	130	
1-1-15	06/22	1130:58-1200:00	29.0	13.4	130	
1-1-17	06/22	1231:01-1300:01	29.0	13.4	130	

1-0- 2	06/20	1852:27-1902:00	4.6	14.4	19	
1-0- 4	06/20	2025:42-2030:00	4.3	14.3	18	
~~1-0- 6~~	~~06/20~~	~~2214:55-2224:34~~	~~9.7~~	~~17.5~~	~~33~~	
1-0- 8	06/20	2245:00-2300:00	15.0	13.4	67	
1-0-10	06/21	0002:00-0030:01	28.0	15.3	110	
1-0-12	06/21	0100:55-0130:00	29.1	13.3	131	
1-0-14	06/21	0200:56-0230:00	29.1	13.3	131	
1-0-16	06/21	0300:56-0330:01	29.1	13.2	132	
1-0-18	06/21	0400:57-0430:01	29.1	13.2	132	
1-0-20	06/21	0500:58-0530:00	29.0	13.3	131	
1-0-22	06/21	0601:00-0630:00	29.0	13.3	131	
1-0-24	06/21	0700:59-0730:00	29.0	13.3	131	
1-0-26	06/21	0800:59-0830:01	29.0	13.3	131	
1-0-28	06/21	1000:28-1030:01	29.6	13.3	133	
1-0-30	06/21	1101:22-1130:00	28.6	13.3	129	
~~1-0-32~~	~~06/21~~	~~1201:25-1230:00~~	~~28.6~~	~~20.2~~	~~85~~	
1-0-34	06/21	1301:19-1330:01	28.7	13.2	130	S
1-0-36	06/21	1400:56-1430:02	29.1	13.2	132	
1-0-38	06/21	1501:00-1530:01	29.0	13.3	131	
1-0-40	06/21	1600:55-1630:00	29.1	13.3	131	
1-0-42	06/21	1701:04-1730:00	28.9	13.4	130	
1-0-44	06/21	1801:05-1830:00	28.9	13.3	130	
1-0-46	06/21	2031:27-2100:00	28.6	13.4	128	
1-0-48	06/21	2131:00-2200:00	29.0	13.4	130	
1-0-50	06/21	2231:06-2300:02	28.9	13.4	130	
1-0-52	06/21	2331:07-0000:01	28.9	13.3	130	
1-0-54	06/22	0031:07-0100:00	28.9	13.4	129	S
1-0-56	06/22	0131:08-0200:00	28.9	13.4	129	
1-0-58	06/22	0231:09-0300:00	28.9	13.4	129	
1-0-60	06/22	0331:09-0400:00	28.9	13.4	129	
1-1- 2	06/22	0430:53-0500:02	29.2	13.4	131	
1-1- 4	06/22	0531:23-0600:00	28.6	13.4	128	
1-1- 6	06/22	0631:20-0700:00	28.7	13.3	129	
1-1- 8	06/22	0800:55-0830:00	29.1	13.3	131	
1-1-10	06/22	0901:06-0930:01	28.9	13.3	130	
1-1-12	06/22	1000:55-1030:01	29.1	13.2	132	
~~1-1-14~~	~~06/22~~	~~1101:01-1130:02~~	~~29.0~~	~~18.5~~	~~94~~	
1-1-16	06/22	1201:06-1230:00	28.9	13.3	130	
~~1-1-18~~	~~06/22~~	~~1300:58-1330:00~~	~~29.0~~	~~20.0~~	~~87~~	

BLM Cruise 4

1-1-19	06/22	1331:20-1400:00	28.7	13.3	129	
1-1-21	06/22	1431:08-1500:01	28.9	13.3	130	S
1-1-23	06/22	1531:09-1600:00	28.9	13.3	130	
1-1-25	06/22	1631:10-1700:00	28.8	13.4	129	S
1-1-27	06/22	1730:59-1800:01	29.0	13.4	130	
1-1-29	06/22	1831:28-1900:00	28.5	13.4	128	
1-1-31	06/22	1931:08-2000:02	28.9	13.3	130	
1-1-33	06/22	2031:17-2100:00	28.7	13.4	129	
1-1-35	06/22	2130:51-2200:00	29.2	13.4	131	
1-1-37	06/22	2231:02-2300:01	29.0	13.4	130	
1-1-39	06/22	2331:05-0000:00	28.9	13.4	129	
1-1-41	06/23	0031:04-0100:01	29.0	13.4	130	
1-1-43	06/23	0131:05-0200:00	28.9	13.3	130	
1-1-45	06/23	0231:07-0300:00	28.9	13.3	130	
1-1-47	06/23	0331:05-0400:01	28.9	13.4	130	
1-1-49	06/23	0431:06-0500:00	28.9	13.3	130	
1-1-51	06/23	0531:27-0600:00	28.6	13.4	128	
1-1-53	06/23	0631:08-0700:02	28.9	13.3	130	
1-1-55	06/23	0831:01-0900:01	29.0	13.3	131	
1-1-57	06/23	1021:06-1050:00	28.9	13.3	130	
1-1-59	06/23	1205:19-1234:01	28.7	13.3	129	
2-0- 1	06/23	1454:26-1524:00	29.6	13.3	133	
2-0- 3	06/23	2110:00-2140:00	30.0	13.3	135	
2-0- 5	06/23	2307:00-2337:00	30.0	13.3	135	
2-0- 7	06/24	0128:53-0158:00	29.1	13.3	131	
2-0- 9	06/24	0331:30-0401:01	29.5	13.4	132	
2-0-11	06/24	0456:00-0526:01	30.0	13.3	135	
2-0-13	06/24	0718:00-0748:00	30.0	13.2	136	
2-0-15	06/24	0831:12-0858:01	26.8	13.3	121	
2-0-17	06/24	0930:00-1000:00	30.0	13.3	135	
2-0-19	06/24	1030:57-1100:01	29.1	13.5	129	
2-0-21	06/24	1142:14-1154:00	11.8	13.3	53	
2-0-23	06/24	1231:10-1300:01	28.9	13.3	130	S
2-0-25	06/24	1330:59-1400:00	29.0	13.4	130	
2-0-27	06/24	1430:59-1500:00	29.0	13.4	130	
2-0-29	06/24	1531:01-1600:00	29.0	13.4	130	
2-0-31	06/24	1631:02-1700:00	29.0	13.4	130	
2-0-33	06/24	1731:01-1800:00	29.0	13.4	130	
2-0-35	06/24	1831:02-1900:00	29.0	13.4	130	
1-1-20	06/22	1401:28-1430:00	28.5	13.3	129	
1-1-22	06/22	1501:23-1530:00	28.6	13.3	129	S
1-1-24	06/22	1601:10-1630:00	28.8	13.3	130	S
1-1-26	06/22	1701:11-1730:00	28.8	13.3	130	
1-1-28	06/22	1800:52-1830:00	29.1	13.3	131	
1-1-30	06/22	1901:01-1930:01	29.0	13.4	130	
1-1-32	06/22	2001:03-2030:00	29.0	13.4	130	
1-1-34	06/22	2101:06-2130:00	28.9	13.3	130	
1-1-36	06/22	2201:10-2230:00	28.8	13.3	130	
1-1-38	06/22	2301:03-2330:01	29.0	13.3	131	
1-1-40	06/23	0001:03-0030:00	29.0	13.3	131	
1-1-42	06/23	0101:05-0130:01	28.9	13.3	131	
1-1-44	06/23	0201:05-0230:00	28.9	13.2	131	
1-1-46	06/23	0301:05-0330:00	28.9	13.3	130	
1-1-48	06/23	0401:07-0430:00	28.9	13.3	130	
1-1-50	06/23	0501:07-0530:00	28.9	13.3	130	
1-1-52	06/23	0601:35-0630:01	28.4	13.3	128	
1-1-54	06/23	0800:00-0830:00	30.0	13.4	134	
1-1-56	06/23	0950:15-1020:01	29.8	13.3	134	
1-1-58	06/23	1134:00-1204:00	30.0	13.4	134	
1-1-60	06/23	1414:14-1444:01	29.8	13.3	134	
2-0- 2	06/23	2004:09-2034:00	29.9	13.4	134	
2-0- 4	06/23	2141:00-2210:00	29.0	13.4	130	
2-0- 6	06/23	2337:46-0007:00	29.2	13.4	131	
2-0- 8	06/24	0158:51-0228:00	29.2	13.4	131	
2-0-10	06/24	0401:56-0431:00	29.1	13.3	131	
2-0-12	06/24	0618:19-0648:00	29.7	13.3	134	
2-0-14	06/24	0810:03-0830:00	20.0	13.3	90	
2-0-16	06/24	0902:50-0927:00	24.2	13.3	109	
2-0-18	06/24	1001:15-1030:00	28.8	13.3	130	
2-0-20	06/24	1100:59-1130:00	29.0	13.3	131	
2-0-22	06/24	1200:00-1230:00	30.0	13.3	135	
2-0-24	06/24	1301:00-1330:00	29.0	13.3	131	S
2-0-26	06/24	1400:59-1430:00	29.0	13.3	131	
2-0-28	06/24	1501:00-1530:01	29.0	13.3	131	
2-0-30	06/24	1600:47-1630:02	29.3	13.3	132	
2-0-32	06/24	1701:01-1730:00	29.0	13.4	130	
2-0-34	06/24	1801:01-1830:00	29.0	13.4	130	
2-0-36	06/24	1901:02-1930:00	29.0	13.3	131	

BLM Cruise 4

2-0-37	06/24	1931:15-2000:00	28.8	13.4	129		2-0-38	06/24	2002:09-2030:00	27.9	13.3	126	
2-0-39	06/24	2031:3.-2100:00	28.4	13.3	128		2-0-40	06/24	2101:03-2130:00	29.0	13.3	131	
2-0-41	06/24	2150:37-2200:00	9.4	13.4	42		2-0-42	06/24	2201:00-2230:02	29.0	13.3	131	S
2-0-43	06/24	2231:06-2300:00	28.9	13.3	130	S	2-0-44	06/24	2301:04-2330:00	28.9	13.3	131	
2-0-45	06/24	2331:05-0000:00	28.9	13.3	130		2-0-46	06/25	0001:05-0030:00	28.9	13.3	130	
2-0-47	06/25	0031:05-0100:00	28.9	13.3	130		2-0-48	06/25	0101:06-0130:01	28.9	13.2	131	
2-0-49	06/25	0130:56-0200:00	29.1	13.3	131		2-0-50	06/25	0201:06-0230:00	28.9	13.3	130	
2-0-51	06/25	0231:06-0300:01	28.9	13.3	130		2-0-52	06/25	0301:07-0330:00	28.9	13.3	130	
2-0-53	06/25	0331:07-0400:00	28.9	13.4	129		2-0-54	06/25	0401:07-0430:00	28.9	13.3	130	
2-0-55	06/25	0431:08-0500:00	28.9	13.3	130		2-0-56	06/25	0501:07-0530:01	28.9	13.3	130	
2-0-57	06/25	0531:34-0600:00	28.4	13.3	128		2-0-58	06/25	0601:08-0630:00	28.9	13.3	130	
2-0-59	06/25	0631:27-0700:01	28.6	13.4	128		2-0-60	06/25	0701:09-0730:01	28.9	13.3	130	
2-1- 1	06/25	0731:10-0800:00	28.8	13.3	130		2-1- 2	06/25	0800:53-0830:02	29.2	13.9	126	
2-1- 3	06/25	0830:59-0900:00	29.0	13.4	130		2-1- 4	06/25	0900:50-0930:01	29.2	13.3	132	
2-1- 5	06/25	0931:11-1000:00	28.8	13.3	130		2-1- 6	06/25	1000:57-1030:00	29.1	13.3	131	
2-1- 7	06/25	1030:56-1100:00	29.1	13.4	130	S	2-1- 8	06/25	1101:05-1130:00	28.9	13.3	130	S
2-1- 9	06/25	1130:59-1200:01	29.0	13.4	130		2-1-10	06/25	1200:49-1230:00	29.2	13.4	131	
2-1-11	06/25	1230:55-1300:00	29.1	13.4	130		2-1-12	06/25	1300:55-1330:01	29.1	13.3	131	
2-1-13	06/25	1331:20-1400:02	28.7	13.3	129		2-1-14	06/25	1402:43-1430:01	27.3	13.3	123	
2-1-15	06/25	1431:05-1500:01	28.9	13.4	130		2-1-16	06/25	1500:48-1530:02	29.2	13.3	132	
2-1-17	06/25	1530:51-1600:00	29.2	13.4	131		2-1-18	06/25	1600:57-1630:00	29.1	13.3	131	
2-1-19	06/25	1630:57-1700:00	29.1	13.4	130		2-1-20	06/25	1700:57-1730:01	29.1	13.3	131	
2-1-21	06/25	1731:05-1800:00	28.9	13.3	130		2-1-22	06/25	1801:00-1830:00	29.0	13.3	131	
2-1-23	06/25	1843:12-1913:00	29.8	13.4	133		2-1-24	06/25	1925:00-1955:01	30.0	13.3	135	
2-1-25	06/25	1956:00-2025:00	29.0	13.4	130		2-1-26	06/25	2025:59-2055:00	29.0	13.4	130	
~~2-1-27~~	~~06/27~~	~~1023:27-1028:00~~	~~4.6~~	~~13.7~~	~~20~~		2-1-28	06/27	1100:00-1130:00	30.0	13.1	137	
2-1-29	06/27	1131:07-1200:01	28.9	13.2	131		2-1-30	06/27	1200:59-1230:00	29.0	13.2	132	
2-1-31	06/27	1231:00-1300:00	29.0	13.3	131		2-1-32	06/27	1300:58-1330:00	29.0	13.2	132	
2-1-33	06/27	1331:01-1400:00	29.0	19.3	90		2-1-34	06/27	1400:51-1430:00	29.2	13.3	132	
2-1-35	06/27	1431:01-1500:00	29.0	13.3	131		2-1-36	06/27	1501:02-1530:00	29.0	13.2	132	
2-1-37	06/27	1531:03-1600:00	29.0	13.3	131		2-1-38	06/27	1601:03-1630:01	29.0	13.2	132	
2-1-39	06/27	1631:04-1700:01	29.0	13.3	131		~~2-1-40~~	~~06/27~~	~~1701:01-1730:00~~	~~29.0~~	~~51.1~~	~~34~~	
~~2-1-41~~	~~06/27~~	~~1911:50-1916:00~~	~~4.2~~	~~13.2~~	~~19~~		2-1-42	06/27	1930:00-2000:01	30.0	13.3	135	
2-1-43	06/27	2000:56-2030:00	29.1	13.2	132		2-1-44	06/27	2031:04-2100:00	28.9	13.3	131	
2-1-45	06/27	2101:01-2130:00	29.0	13.2	132		2-1-46	06/27	2132:16-2200:01	27.8	13.3	125	
2-1-47	06/27	2200:58-2230:00	29.0	13.2	132	S	2-1-48	06/27	2230:53-2300:01	29.1	13.2	132	
~~2-1-49~~	~~06/27~~	~~2322:41-2326:00~~	~~3.3~~	~~13.3~~	~~15~~		2-1-50	06/27	2330:00-0000:00	30.0	13.2	136	S
2-1-51	06/28	0000:55-0030:01	29.1	13.1	133		2-1-52	06/28	0031:18-0100:01	28.7	13.3	130	
2-1-53	06/28	0101:08-0130:00	28.9	13.1	132		2-1-54	06/28	0131:13-0200:00	28.8	13.3	130	

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2-1-55	06/28	0201:05-0230:01	28.9	13.2	132	
2-1-57	06/28	0301:06-0330:00	28.9	13.1	132	
2-1-59	06/28	0401:12-0430:02	28.8	13.1	132	
3-0- 1	06/28	0509:26-0526:00	16.6	13.3	75	
3-0- 3	06/28	0600:52-0630:00	29.1	13.1	133	
3-0- 5	06/28	0700:42-0730:00	29.3	13.1	134	
3-0- 7	06/28	0800:49-0830:00	29.2	13.2	133	
3-0- 9	06/28	0900:49-0930:00	29.2	13.2	133	
3-0-11	06/28	1001:15-1030:00	28.8	13.2	131	
3-0-13	06/28	1100:55-1130:00	29.1	13.2	132	
3-0-15	06/28	1230:00-1300:00	30.0	13.3	135	S
3-0-17	06/28	1330:43-1400:00	29.3	13.3	132	
3-0-19	06/28	1430:51-1500:01	29.2	13.3	132	
3-0-21	06/28	1530:54-1600:00	29.1	13.3	131	
3-0-23	06/28	1630:55-1700:00	29.1	13.3	131	
3-0-25	06/28	1730:50-1800:01	29.2	13.3	132	
3-0-27	06/28	1831:16-1900:01	28.8	13.3	130	S
3-0-29	06/29	0801:09-0830:00	28.9	13.2	131	
3-0-31	06/29	0901:01-0930:01	29.0	13.2	132	
3-0-33	06/29	1000:49-1030:00	29.2	13.2	133	
3-0-35	06/29	1200:58-1230:00	29.0	13.2	132	
3-0-37	06/29	1301:02-1330:00	29.0	13.2	132	
3-0-39	06/29	1401:01-1430:00	29.0	13.2	132	
3-0-41	06/29	1501:03-1530:01	29.0	13.2	132	
3-0-43	06/29	1601:01-1630:00	29.0	13.2	132	
3-0-45	06/29	1701:05-1730:00	28.9	13.1	132	
3-0-47	06/30	0622:03-0652:00	30.0	13.3	135	
3-0-49	06/30	0856:29-0926:00	29.5	13.2	134	
3-0-51	06/30	1009:01-1038:00	29.0	13.2	132	
3-0-53	06/30	1249:07-1318:00	28.9	13.1	132	S
3-0-55	06/30	1434:13-1504:00	29.8	13.3	134	
3-0-57	06/30	1544:06-1613:01	28.9	13.2	131	
3-0-59	06/30	1726:09-1755:00	28.9	13.2	131	
3-1- 1	06/30	1942:10-2012:00	29.8	13.2	136	
3-1- 3	06/30	2203:14-2233:00	29.8	13.1	136	S
3-1- 5	07/01	0515:43-0545:01	29.3	13.1	134	
3-1- 7	07/01	0803:03-0833:00	30.0	13.1	137	S
3-1- 9	07/01	0923:51-0953:00	29.2	13.2	133	
3-1-11	07/01	1101:07-1131:00	29.9	13.2	136	

2-1-56	06/28	0231:08-0300:00	28.9	13.2	131	
2-1-58	06/28	0331:05-0400:00	28.9	13.2	131	
2-1-60	06/28	0431:16-0500:00	28.7	13.3	130	
3-0- 2	06/28	0530:00-0600:00	30.0	13.2	136	
3-0- 4	06/28	0631:03-0700:00	29.0	13.3	131	
3-0- 6	06/28	0730:53-0800:00	29.1	13.2	132	
3-0- 8	06/28	0831:11-0900:00	28.8	13.2	131	
3-0-10	06/28	0931:01-1000:00	29.0	13.3	131	
3-0-12	06/28	1031:03-1100:00	29.0	13.3	131	
3-0-14	06/28	1130:55-1200:00	29.1	14.9	117	
3-0-16	06/28	1300:56-1330:00	29.1	13.2	132	S
3-0-18	06/28	1400:50-1430:01	29.2	13.2	133	
3-0-20	06/28	1500:48-1530:00	29.2	13.2	133	
3-0-22	06/28	1600:48-1630:00	29.2	13.2	133	
3-0-24	06/28	1700:49-1730:00	29.2	13.2	133	
3-0-26	06/28	1801:00-1830:00	29.0	13.2	132	S
3-0-28	06/29	0730:00-0800:01	30.0	13.2	136	
3-0-30	06/29	0831:39-0900:00	28.4	13.3	128	
3-0-32	06/29	0931:02-1000:00	29.0	13.3	131	
3-0-34	06/29	1130:00-1200:00	30.0	13.3	135	
3-0-36	06/29	1231:02-1300:00	29.0	13.3	131	
~~3-0-38~~	~~06/29~~	~~1331:03-1400:00~~	~~29.1~~	~~24.8~~	~~70~~	
3-0-40	06/29	1431:03-1500:00	29.0	13.3	131	
3-0-42	06/29	1531:05-1600:00	28.9	13.3	130	
3-0-44	06/29	1631:05-1700:00	28.9	13.2	131	
3-0-46	06/29	1731:05-1800:00	28.9	13.2	131	
3-0-48	06/30	0653:42-0722:01	28.3	13.3	128	
3-0-50	06/30	0938:38-1008:00	29.4	13.2	133	
3-0-52	06/30	1218:02-1248:00	30.0	13.1	137	
3-0-54	06/30	1319:08-1348:00	28.9	13.1	132	S
3-0-56	06/30	1513:11-1543:00	29.8	13.2	136	
3-0-58	06/30	1655:03-1725:00	30.0	13.3	135	
3-0-60	06/30	1756:57-1825:00	28.1	13.3	127	
3-1- 2	06/30	2012:50-2042:01	29.2	13.1	134	S
~~3-1- 4~~	~~06/30~~	~~2233:47-2303:00~~	~~29.2~~	~~32.5~~	~~54~~	
3-1- 6	07/01	0803:03-0833:00	30.0	13.1	137	
3-1- 8	07/01	0853:51-0923:00	29.2	13.2	133	S
3-1-10	07/01	0954:05-1023:01	28.9	13.2	132	
3-1-12	07/01	1242:26-1312:00	29.6	13.1	135	

BLM Cruise 4

3-1-13	07/01	1312:51-1342:00	29.2	13.2	133	S	3-1-14	07/01	1422:47-1452:00	29.2	13.3	132
3-1-15	07/01	1452:56-1522:00	29.1	13.3	131							

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